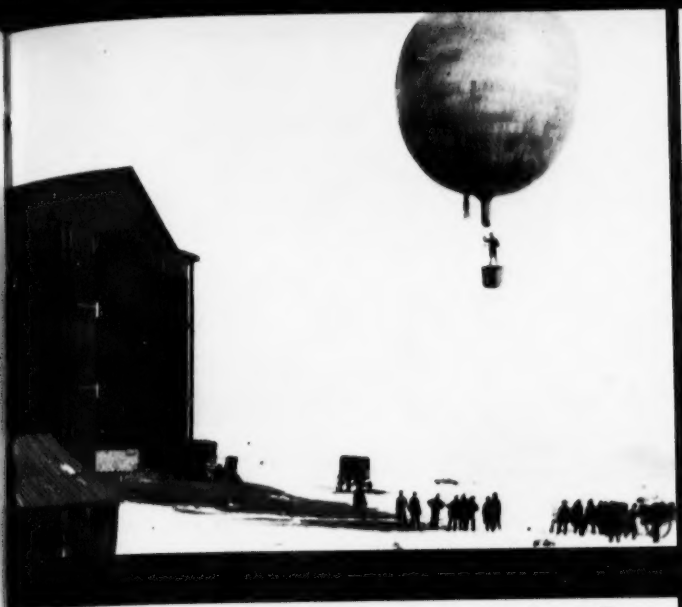

UNITED STATES ARMY

AVIATION DIGEST

20th Anniversary of Army Aviation

THE ARMY AVIATION STORY

Page 2

JUNE 1962

UNITED STATES ARMY AVIATION DIGEST

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of a operational or functional nature concerning safety and aircraft accident prevention, trainin maintenance, operations, research and development, aviation medicine, and other related da

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communica tion is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

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SECRETARY OF THE ARMY
WASHINGTON

It is a pleasure to greet the officers and men of the youngest and most versatile element of the Army team on its twentieth anniversary.

From a nucleus of light aircraft used for artillery adjustment, liaison, and observation in World War II, Army Aviation has grown to a position of great importance in our modern, highly mobile Army. It affords the means to surmount obstacles and achieve surprise, and otherwise provides a degree of mobility never known before on the battlefield. Its tremendous potential has just begun to be realized, and its capabilities are limited only by the imagination of its users.

I join all members of the United States Army in expressing pride in the tremendous advance made by Army Aviation over the past two decades. I am confident it will meet the challenges of the future with the same fine spirit that has made this progress possible.

Elvis J. Stahr, jr.
Secretary of the Army

The Army Aviation Story

Richard K. Tierney

PART I

TWENTY YEARS ago this month America was mobilizing for an all-out war effort against the Axis. At Fort Sill, Okla., the Artillery School was a scene of intense activity. But, in odd contrast to the surrounding hustle and bustle, a small group of Army officers and enlisted men patiently marked time as they participated in limited flight and maintenance training programs.

These men were waiting for a decision on the results of a test—a test which led to the birth of Army Aviation. They had evaluated the concept of using light aircraft organic to the Field Artillery to spot targets. After-action reports had been submitted, and for two months the men had been waiting—and hoping they had convinced the War Department that the Artillery needed its own light aircraft to quickly and effectively detect targets hidden to ground observers.

The group was rewarded for its efforts and patience when the War Department approved organic aviation for the Field Artillery on 6 June 1942. This date is now officially recognized as the birthday of Army Aviation.

Why 6 June 1942? Certainly the United States Army was as-

sociated with aviation and aerial observation much earlier. A review of this early history bears out the major role the U. S. Army played in the development of aviation and aerial observation. But it also reveals why Army Aviation—that is, the concept of aviation in support of the ground battle—had to wait until 1942 to be born.

THE BALLOONISTS

Another war-torn June 6th also is important in the history of Army Aviation. It was on that date in 1861 that Professor Thaddeus S. C. Lowe arrived in Washington, D. C., to demonstrate a wartime use for balloons. An accomplished balloonist, Lowe was destined to direct the Army's first air arm. He had come to the Nation's Capital to convince government officials that captive balloons could be used as observation platforms and perhaps even direct artillery fire on enemy forces.

Lowe's ideas were not entirely new. Throughout history Army commanders have had observers climbing trees and mountains in an effort to reconnoiter the enemy. Even as Lowe was demonstrating his ideas in Washington, Federal and Confederate troops alike were building observation and signal platforms on the tops of houses and mountains and in trees. In many cases permanent towers were constructed to enable observers to keep an eye on the enemy.

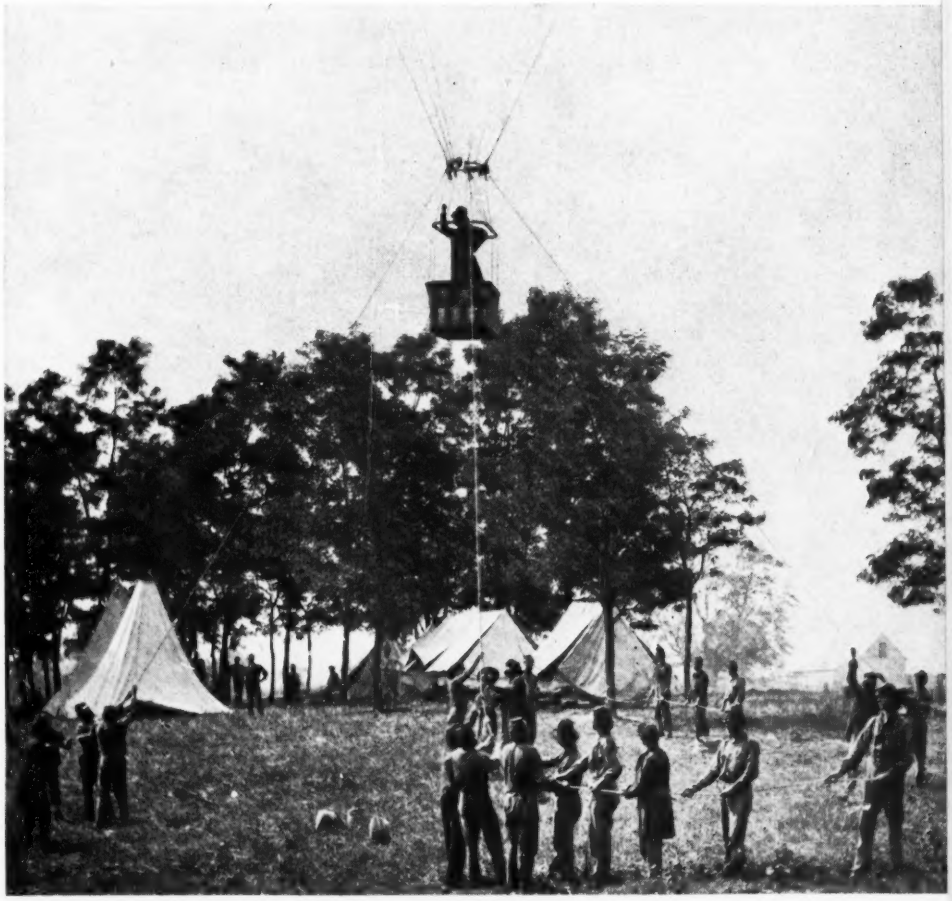
Lowe had several contemporaries, notably John Wise, John La Mountain, and James Allen, who came to Washington for the same purpose with similar ideas. Allen actually was the first balloonist to work with the Army during the Civil War. He also was the first to arrive in Washington (19 April) after the outbreak of hostilities, and on 9 June made his first balloon ascension while associated with the Army.

The balloons used by the aeronauts varied in size, holding usually from 10,000 to 25,000 cubic feet of hydrogen. Balloon envelopes were generally made of silk, covered by varnish or other nonporous substance to prevent the hydrogen from escaping. The balloons usually carried a basket large enough to accommodate two people.

All four balloonists worked in an official capacity with the Army, but retained their civilian status and operated independently of one another (although Allen was later employed by Lowe). Wise and Allen met with only limited success. La Mountain was more successful, but it was Professor Lowe who got the best results from the use of balloons at the front. He sent the first telegraph message from a balloon on 18 June 1861 and successfully directed the first artillery fire from a balloon on 24 September. Primarily due to his efforts the Army's first air arm, the Balloon Corps of the Army of the Potomac, was organized in September 1861. Lowe was the first man to be placed in charge of the Balloon Corps, which remained in existence until June 1863.

THADDEUS S. C. LOWE

Professor Lowe had brought his balloon, the "Enterprise," with him to Washington. On 11 June 1861 he was invited to the White House where he dis-



cussed his plans with President Lincoln. The President was receptive and promised that serious consideration would be given to the employment of balloons by the Army.

One week later Lowe conducted his first demonstration for the War Department. Accompanied by a telegraph official and an operator, Lowe ascended in the "Enterprise" to an altitude of 500 feet. Aboard was a telegraph instrument (key) attached to a line which ran to the White House via the Alexandria, Va., telegraph office and the War Department. During this ascension Lowe sent the first message transmitted by wire from an air vehicle:

Balloon Enterprise,
June 18, 1861

TO THE PRESIDENT OF THE UNITED STATES

Sir:

This point of observation commands an area nearly 50 miles in diameter. The city, with its girdle of encampments, presents a superb scene. I have pleasure in sending you this first dispatch ever telegraphed from an aerial station, and in acknowledging indebtedness for your encouragement for the opportunity of demonstrating the availability of the science of aeronautics in the military service of the country.

T. S. C. Lowe

The experiment was impressive and the next day Professor Lowe was called upon for a repeat performance on the White House lawn for the President and members of his cabinet.

Meanwhile Confederate troop movements in northern Virginia were beginning to menace the security of the District of Columbia. Reports indicated that 20,000 Confederate troops were massing in the vicinity of Manassas and Fairfax Court House. Since the exact positions of the Confederates were unknown, the Army asked Professor Lowe to take his balloon to Falls Church and determine the location of the enemy. Despite delays in obtaining gas and troops to help move the balloon, Professor Lowe finally got the balloon inflated and moving through the Washington streets. The following report was carried in the *Washington Star*:

> Professor Lowe's mammoth balloon was inflated yesterday, and carried through our streets and those of Georgetown. Although the car was near the ground, the monster loomed up above the tallest houses. It was carried across the Alexandria Aqueduct, and in the afternoon was seen riding majestically, high above the Virginia hills, in the vicinity of Fort Corcoran. Many of our citizens were out to take a peep at it; and many wise remarks were hazarded about the probability of the Confederates sending a rifle shot through it and letting the observer down. The reconnoitering will be done by a military officer, who can communicate with those below by a "paper express," that is, the message is weighted with a bullet and run down the cord by being attached to a string.

On 22 June Professor Lowe ascended near Manassas and Fairfax Court House, but reported nothing of importance. The next day he made several ascensions in the Falls Church area, but high winds hampered the operation; again nothing of importance was learned.

Federal plans called for an offensive to be launched across the Potomac River in July, and it appears that extensive use of Lowe's balloon was planned. At any rate Lowe inflated his balloon at the Washington gas works and had it towed to the Falls Church area. There, much to his astonishment, he was overrun by fleeing Federal troops and terrified spectators who had been routed at Bull Run. Lowe hurriedly returned with his balloon to Fort Corcoran, across the Potomac River from Georgetown.

Meanwhile the Federal troops and the civilians who had traveled to Manassas to witness the "defeat" of the outnumbered Confederates were streaming back into Washington. Their stories of the disaster at Bull Run soon had rumors flying, and Washington officials were expecting the Confederates momentarily to invade the Capital. Lowe relieved their anxiety, however, and squashed the rumors by making several ascents and reporting the movements of the Confederates, who were not following up the victory or endangering Washington. Lowe's efforts not only relaxed a tense situation, but also spared unnecessary, hurried deployment of troops to defend the Capital.

On 2 August 1861 Lowe's observation program received a boost when he received authorization to obtain a new 25,000 cubic foot capacity balloon. This balloon, delivered on 21 August and christened the "Union," was used extensively from 29 August until 1 October in the Washington area. It was from this balloon that the Confederates were discovered building earthworks around Washington.

The deployment of Confederate troops within range of Union guns presented Lowe the opportunity to adjust artillery fire from his balloon. Available records indicate that he first directed artillery fire from a balloon on 24 September 1861 from the Fort Corcoran area. He telegraphed his observations to an artillery officer located over 3 miles away. Range and deflec-

tion corrections also were signaled to a ground observer by flag. Excellent results were obtained and this practice was used extensively in the Peninsula Campaign.

THE ARMY'S FIRST AIR ARM

The Balloon Corps was added to the Army of the Potomac on 25 September 1861 when instructions from the Secretary of War directed Lowe to construct four additional balloons. Lowe was designated Chief Aeronaut and placed in charge of the new service.

By January 1862, Lowe's balloon operations had expanded considerably. He had seven balloons, and at least four aeronauts were observing along the Potomac. When the Confederates withdrew from the Washington area, the aeronauts were ordered to accompany and support the Army in new campaigns. Thus, balloon operations spread during 1862 and often met with great success in various campaigns, ranging from the Mississippi River, to Old Point Comfort, Va., and south to Mobile, Ala.

However, things were not always rosy for the aeronauts. Frequently balloon operations proved unsatisfactory, and friction grew between Lowe's group and Army commanders. One incident marked the beginning of the end of Lowe's association with the Army and the Balloon Corps. In May 1863 Lowe witnessed the defeat of General "Fighting" Joe Hooker's army by General Robert E. Lee at Chancellorsville. From the vantage point of his balloon, Lowe issued reports on Confederate movements. But it appears the reports were either ignored or could not be used to advantage. At any rate, it seems Lowe became disgusted and shortly after left the Balloon Corps and returned to exhibition flying.

Balloons Over Old Point

We learned from a gentleman late last night, whose information is entirely reliable, that two balloons were sent up from Fortress Monroe yesterday. They were attached to the Fort by a rope. What the object of these ascensions was we can of course only conjecture. They were undoubtedly reconnoitering and examining our formidable batteries scattered all around them, and were probably endeavoring to get a bird's eye view of a few of those dreadful masked batteries which everywhere cause the Federalists so much alarm.

PETERSBURG EXPRESS
From "A Century Ago in The Enquirer," *The Columbus Ledger-Enquirer*, June 20, 1961

In June the Army ordered the Balloon Corps to be placed under the jurisdiction of the Signal Corps. But the Signal Corps objected on the grounds that it had neither sufficient funds nor personnel to support the new organization. Consequently, the Balloon Corps was returned to Washington and disbanded later in June 1863.

THE CONTRIBUTION

The Balloon Corps', and specifically Lowe's, contribution to the concept of Army Aviation cannot be minimized. Here were aerial observers who supported the ground forces just as Army Aviation does today. They provided the ground commander with adjustment of artillery fire; invaluable information concerning troop concentrations and movement, both before and during engagements; and maps and sketches of enemy positions and gun emplacements. Army commanders often counted heavily on this information in the preparation of both strategical and tactical operations. In fact, Union commanders enjoyed enough success with their balloon operations to attract the attention of Germany's Count Ferdinand von Zeppelin, who came to the United States to observe firsthand the work of the Balloon Corps.

The Confederates also were aware of the effectiveness of the North's Balloon Corps. Confederate Brig Gen E. P. Alexander was quoted as saying, "Even if the observers never saw anything, they would be worth all they cost for the annoyance and delays they caused us in trying to keep our movements out of sight." Eighty years later German officers echoed the same thoughts when speaking of the Army's "Grasshoppers" in World War II.

The balloons did prove bothersome to the South. The Confederates took great pains to camouflage their positions and enforce blackouts. They mounted dummy guns to give the impression of numerous troop concentrations and to deceive the Federals.

The Confederates also thought enough of balloons to employ them for observation purposes. The most successful Confederate aeronaut was Captain John Ran-

dolph Bryan, who made several ascensions in the Yorktown, Va., area. Other notable Confederate aeronauts include Richard Wells and Charles Cevor, who both operated primarily in the Deep South. The South's balloon activities never reached the proportions of the North's and after May 1862 faded from the scene.

Recognizing the significance of Lowe's contribution to the evolution of the Army Aviation concept, the Army has named its primary fixed wing training installation, Lowe Army Airfield (Fort Rucker, Ala.), in his honor.

But the organization of the Balloon Corps of the Army of the Potamac cannot be considered as the birth of Army Aviation. While the concept was readily accepted by Army commanders, too often the available equipment could not do a dependable, satisfactory job.

Poor equipment, unfavorable weather, and a shortage of trained personnel to maintain and handle the balloons proved disastrous to Lowe as well as his independent contemporaries. For example, Wise's services as a military balloonist came to an end when his balloon was being hauled to Ball's Cross Roads to observe the enemy. A breeze came up and blew the balloon into some telegraph wires. The handling guys were severed, the balloon escaped and had to be shot down.

Allen experienced similar troubles. One of his balloons blew up while being inflated and the other was destroyed when the wind blew it into a telegraph pole. This ended Allen's service until he later went to work for Lowe.

La Mountain's balloon, the "Saratoga," was lost when it broke its moorings and disappeared beyond Confederate lines. His only other balloon, the "Atlantic," had been used extensively and was in bad condition.

La Mountain sought to continue his operations by requesting that the Army assign him one of the balloons under Lowe's command. But this only widened an already serious controversy between the two aeronauts. La Mountain lost the dispute and his operations ended on 19 February 1862.

The internal organization of the Balloon Corps was itself a handicap. Tactical command was under a corps or division commander, who directed operations through a civilian aeronaut charged with command of military personnel handling the balloon. Administration was shuffled from the Topographical Engineers to the Quartermaster Corps to the Corps of Engineers. These circumstances made it most difficult to obtain supplies, personnel or finances.

Another handicap was the fact that the employment of balloons in combat was new to Army commanders. Many times commanders obtained excellent results. But in other cases, they found they could not depend on the Balloon Corps. Often they requested a balloon for observation only to learn it was not available, having been torn and destroyed by tree limbs or telegraph wires, or that inadequate supplies of hydrogen prevented its inflation.

Charges have been made that Army commanders sometimes failed to utilize the Balloon Corps properly. But it must be remembered that the Balloon Corps was new and many commanders simply were not aware of its potential. Also Army commanders were fighting a bloody war and did not always have ample time to experiment on the battlefield.

Still, Lowe and his aeronauts, despite their disgust and disbandment, were immensely successful. They had proved to many Army commanders that aerial observation could be invaluable in support of the ground commander.

The Balloon Corps was disbanded, but Army commanders did not forget the value of aerial observation. The Cavalry covered ground too swiftly for balloon operations during the Indian Wars, but the concept remained alive in the minds of Army officers and was soon to be resurrected in the Spanish-American War.

BALLOON CORPS RE-ESTABLISHED

The growth of the Signal Corps and the foresight of such officers as Brig Gen Adolphus W. Greely and Brig Gen James Allen led to the re-establishment of balloon operations, and the incorporation of the dirigible and the airplane within the U. S. Army.

General Greely was Chief Signal Officer from 3 March 1887 until his promotion and transfer, 9 February 1906. He was replaced by General Allen, who carried on the aeronautic policies of his former chief.

A balloon section created in 1892 by General Greely was the beginning of the first all-military aeronautic organization in the U. S. Army.

Signal Corps plans in 1892 called for a balloon section as part of each telegraph train. A balloon secured by Lt William A. Glassford from the French firm of Lachambre was the first obtained for these plans. The balloon was named "General Myer" in honor of the first chief of the Signal Corps. The "General Myer" was used extensively over the next few years until destroyed by high winds.

Despite early enthusiasm, the

The Army's "Santiago" during the attack at San Juan Hill, Cuba on 1 July 1898.

years leading up to the Spanish-American War were lean for Signal Corps balloonists. At the outbreak of the war the Army had only one available balloon, a well worn relic of the Civil War, and no trained personnel to operate it.

Lt Col Joseph E. Maxfield, charged with the organization of two balloon companies, was dismayed to find that his only balloon, when inflated, had the somewhat uneven appearance of a "misshapen pumpkin." The only "modern" feature aboard the basket was a telephone, which replaced the telegraph used in Professor Lowe's day.

This odd shaped balloon — destined to be christened the "Santiago" and to participate in the battle of San Juan Hill — was moved to New York to watch for an anticipated invasion of Manhattan by the Spanish.

Realizing such a bold attack would never materialize, General Greely suggested the balloon be used in Cuba. Despite numerous transportation snarls, the balloon finally arrived in Cuba on 28 June 1898.

Heavy rains and intense heat caused the varnished silk envelope to stick together, and the underbrush had torn it in numerous places. Hurriedly patched with surgical adhesive tape, three ascents were made in the balloon on the afternoon of the 30th. The third aerial reconnaissance was made at the request of the commanding general, Maj Gen William Shafter. The observations provided the Army with valuable information on roads to the front and the location of the Spanish fleet in Santiago harbor.

On the morning of July 1st the Army prepared to launch an attack on San Juan Hill to destroy the heavily garrisoned blockhouse, the last remaining obstacle on the road to Santiago. Colonel Maxfield was ordered to have his balloon keep pace with the lead units of the Army.

The balloon was sent aloft. According to Colonel Maxfield's observations, it presented a most tempting target as a wagon bore it along with the advancing troops.

A volunteer from New York, Pvt Charles Johnson Post reported:

> We heard yells and cheers from the rear of our columns. An observation balloon came into sight high above the jungle. A four-man ground crew held its trail rope and kept the balloon under control. Signal Corps men followed with coils of the rope, which they payed out or took in according to the directions from the basket of the balloon above. Two heads peered over the rim of the basket and occasionally a little note would flutter down. The trail rope led directly down into the Aguadores road; it was a beautiful range marker for the Spanish artillery and infantry, and they promptly used it as such.

Lt Col John D. Miley, Maj Gen William Shafter's aide-de-camp, wrote:

> Winding its way among the troops the balloon was soon within a few hundred yards of the Aguadores River. The enemy's musketry fire was already becoming quite spirited, but when the balloon reached this point it was opened upon by a heavy fire from field-guns and musketry fire also increased. The third shell or shrapnel fired at the balloon struck it, and the next one tore it so badly that it at once descended. Time enough, however, was afforded Colonel Derby to discover a road leading from the main road to the left and crossing the Aguadores River four or five hundred yards farther down the stream. This was a most opportune discovery as the main road was congested with troops and the fire so heavy as to tend to demoralize the men.

The "Santiago," too badly damaged to be used again, may

have been responsible for heavy casualties from Spanish artillery fire. But it also seems to have been one of the determining factors in the capture of San Juan Hill. General Greely remarked, "This action enabled the deployment of our troops over two roads, and by doubling the force may possibly have been the determining factor in the gallant capture of San Juan Hill."

Army officers like General Greely knew the value of aerial observation — and they knew the inadequacies of available equipment. After the Spanish-American War they watched with envy the increasingly successful use of military dirigible balloons by European powers, and eagerly anticipated the development of a heavier than air flying machine.

The Army organized a balloon detachment in May 1902 at Fort Myer, where the Signal Corps balloon equipment had been stored for two years. Since the equipment had deteriorated beyond use, a new balloon was purchased for maneuvers in Connecticut, and met with limited success after numerous logistical obstacles were overcome.

The Army's balloon activity remained fairly stagnant until the spring of 1907 when the Signal Corps purchased a new balloon — Signal Corps Balloon No. 9 (the ninth balloon obtained since the Civil War). Another larger balloon which had been ordered in 1906 was accepted on 4 June 1907 and became Signal Corps Balloon No. 10.

BALLOONS IN WORLD WAR I

Under the guidance of General Allen, a balloon house and hydrogen plant was established at Fort Omaha in 1908. However, ballooning in the U. S. Army retrogressed over the next several years. When the United States entered World War I the Army had only three serviceable free balloons and two captive balloons on hand.

The training program at Fort Omaha was immediately stepped up and newly organized balloon companies were sent to field artillery firing centers and new schools at San Antonio, Texas, Fort Sill, Okla., Arcadia, Calif., and Lee Hall, Va. Balloon observers received further training at the American School, Camp Souge, France, and at French schools and artillery centers.

By 15 April 1918 the Army had two balloon companies operating against the enemy. By Armistice Day the Army had trained 89 balloon companies and 751 balloon officers in America. Thirty-three companies and 117 officers were sent overseas to join the 2 balloon companies organized in France. In all, the Army's balloon operations in France totaled 446 officers and 6,365 enlisted men. Of the 265 balloons sent to France, 77 participated in action. The Army employed 252 balloon observers within 23 companies. It lost 48 balloons; official German losses were set at 73.

A captain in the Air Service wrote that observation balloonists noted any changes within 5 miles back of German lines and reported their findings to ground stations and other balloons by telephone. During actual fighting they watched for new enemy batteries to open up and the appearance of hostile aircraft, which often forced the observers to make parachute jumps. The balloons would ascend as high as 4,500 feet and remain in the air for hours from 2½ to 4½ miles from enemy lines. The balloonists could see about 8 miles in all directions. At the start of battle a large number of balloons would be sent up. Specific duties divided among

U. S. Army Dirigible Balloon No. 1 hovers before embarking on a trial flight in the summer of 1908 at Fort Myer, Va. The crew ran back and forth to make the craft rise or descend.

them included: recording heavy artillery fire, shot by shot, observing demolition behind enemy lines, and watching for reinforcements or traps, the shifting of enemy positions, the assembly of supplies by the enemy, and the forward movement of enemy troops.

In all, the Army's balloon operations in World War I accounted for 1,642 ascensions; 3,111 hours in the air; 316 artillery adjustments; 12,018 shell bursts reported; and numerous other types of intelligence recorded.

After the armistice, numerous lighter-than-air projects were cancelled, and by the summer of 1920, the Army's authorized balloon strength was cut to 29 companies. With the introduction of the fighter plane during the war, the balloon became exceedingly vulnerable and quickly faded from the scene as a useful implement of war.

But, as proved along the Potomac and at San Juan Hill, aerial observation provided invaluable support to the ground commander, both as a source of intelligence and as a means of directing artillery fire. The balloon companies and the airplane operations of World War I convinced many Army officers that aerial observation in support of the ground commanders was essential. This concept would grow among ground commanders, and 24 years later it would blossom into our present concept of Army Aviation.

THE AIRSHIPS

Before the Spanish-American War, General Greely began trying to obtain funds for the development of a dirigible, but his pleas went unheeded.

It fell to his successor, General Allen, to find the way. In November 1907, he obtained $25,000 from the War Department Board of Ordnance and Fortification to procure an experimental nonrigid dirigible balloon for the Signal Corps.

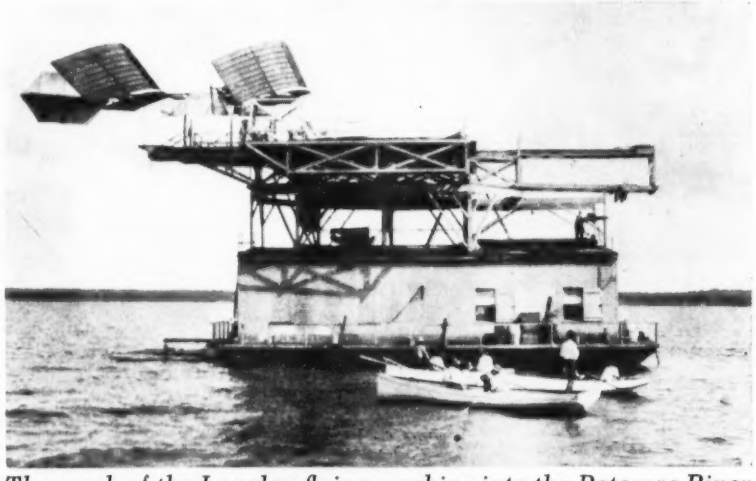
A contract was awarded to the lowest bidder, Thomas Scott Baldwin. His quotation was $6,750.

By 18 August 1908 an airship propelled by a gasoline engine had been built and successfully completed a series of performance trials. Baldwin then taught Lieutenants Frank P. Lahm, Thomas E. Selfridge, and Benjamin D. Foulois to fly the dirigible. On the 22d the airship was officially accepted and became U. S. Army Dirigible Balloon No. 1. This airship made several demonstration flights around the United States, but was not used after 1909. In 1912 it was condemned and sold.

The Army did not acquire another airship until 1919 when another nonrigid airship was procured.

Airships were not used by the Army in France during World War I, but by the summer of 1920 the Army had seven nonrigid airships. However the airship, like the balloon, was

HIGH HOPES



The crash of the Langley flying machine into the Potomac River on 7 October 1903, was a bitter disappointment for the Army.

. . . OOPS!

National Air Museum, Smithsonian Institution photos.

Advertisement and Specification For a Heavier-Than-Air Flying Machine

This specification covers the construction of a flying machine supported entirely by the dynamic reaction of the atmosphere and having no gas bag.

It is desirable that the flying machine should be designed so that it may be quickly and easily assembled and taken apart and packed for construction in army wagons. It should be capable of being assembled and put in operating condition in about one hour.

The flying machine must be designed to carry two persons having a combined weight of about 350 pounds, also sufficient fuel for about 125 miles.

The flying machine should be designed to have a speed of at least 40 miles per hour in still air.

Before acceptance a trial endurance flight will be required of at least one hour during which time the flying machine must remain continuously in the air without landing. During this flight it must be steered in all directions without difficulty and at all times under perfect control and equilibrium.

It should be sufficiently simple in its construction and operation to permit an intelligent man to become proficient in its use within a reasonable length of time.

The price quoted in proposals must be understood to include the instruction of two men in the handling and operation of this flying machine. No extra charge for this service will be allowed.

SIGNAL OFFICE

Washington D. C., December 23, 1907.

Figure 1

nudged from the scene by the airplane.

THE FLYING MACHINE

Shortly after the turn of the century Congress appropriated $25,000 for the War Department to "build a flying machine for war purposes." General Greely turned to an old friend, Professor Samuel P. Langley, director of the Smithsonian Institution, for assistance. Dr. Langley had been experimenting in aerodynamics since 1885. In 1896 he built a steam driven model airplane that flew three-fourths of a mile along the Potomac River. He agreed to build a full-sized test machine for $50,000.

On 7 October 1903, Dr. Langley's "Aerodrome A," as he called his flying machine, was launched from a houseboat in the Potomac River. However, the test was unsuccessful and the "Aerodrome" crashed into the river. Eight weeks later a second attempt to fly the "Aerodrome" also failed.

Reasons given for the failures were that the center of gravity was off, and that the engine was not powerful enough.

These failures resulted in severe attacks on both Congress and the Army for "squandering money on such an impossible invention." Consequently the project was cancelled.

Meanwhile Wilbur and Orville Wright's aerodynamic experiments reached a successful climax on 17 December 1903 when they made their first airplane flight at Kitty Hawk, N. C. However the Army, recalling the abuse it had absorbed over the Langley failure, remained skeptical about the Wrights' success and did not state performance requirements for an airplane until 1907. Consequently the job — and honor — of introducing airplanes to the Army fell to General Allen.

THE AERONAUTICAL DIVISION

In the history of Army Aviation, 1907 was an important year. As noted, a contract was awarded to build U. S. Army Dirigible No. 1; an Aeronautical Division in the office of the Chief Signal Officer was established on 1 August; and the United States became the first country to contract for a military airplane when the Signal Corps called for bids (see fig. 1) in December 1907.

The Aeronautical Division, responsible for all matters pertaining to military ballooning, air machines and all related subjects, was first headed by Capt Charles deForest Chandler.

On 1 February 1908, the Army received 41 bids for a military airplane. Only three bidders met the requirements outlined in the specifications:

Mr. J. F. Scott, Chicago, $1,000, 185 days.

Mr. A. M. Herring, New York City, $20,000, 180 days.

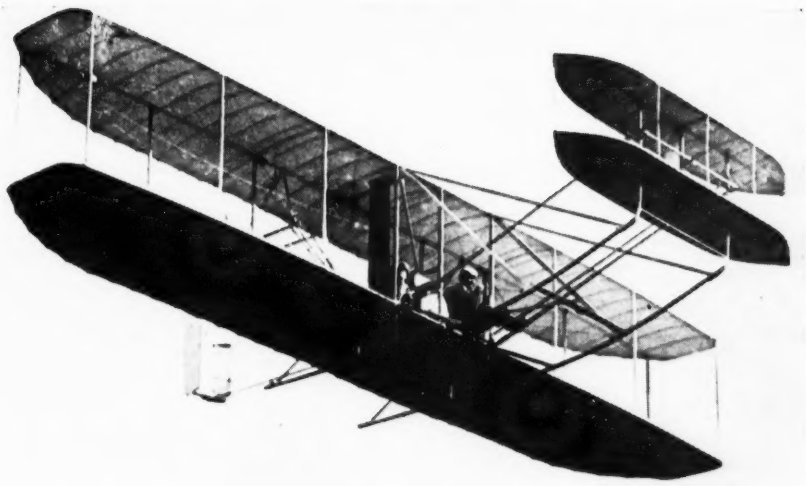
Wright Brothers, Dayton, Ohio, $25,000, 200 days.

All three bids were accepted but only the Wright Brothers' airplane was ever delivered and accepted.

On 20 August 1908, the

Wrights brought their plane, a modified version of their 1905 airplane, to Fort Myer, Va., for testing.

It was a pusher type, with the motor and prop located behind the pilot and passenger. On 3 September the first flight, lasting 1 minute and 11 seconds, was made. This flight, the first of an airplane on a military installation in America, was followed by a series of test flights that were highlighted on the afternoon of 9 September when Orville remained aloft for 1 hour, 2 minutes, and 15 seconds.



Orville Wright makes a pass over Fort Myer, Va., during a trial flight in September 1908.

Just as success seemed imminent, tragedy struck at Fort Myer. On 17 September 1908, Orville invited Lt Thomas E. Selfridge, an official Army observer at the trials, to ride as a passenger on a test flight. On the fourth turn of the field one of the props struck a brace wire attached to the rudder. An eyewitness account reported in the *Washington Post* stated: "The spectators saw a fragment of something fly from the machine and describe an arc in the air.

" 'That's a piece of one of the propellers' shouted one of the officers. 'I wonder what will happen to —! My God, they're falling!' " The airplane, twisting and turning, fell 150 feet and hit with tremendous force.

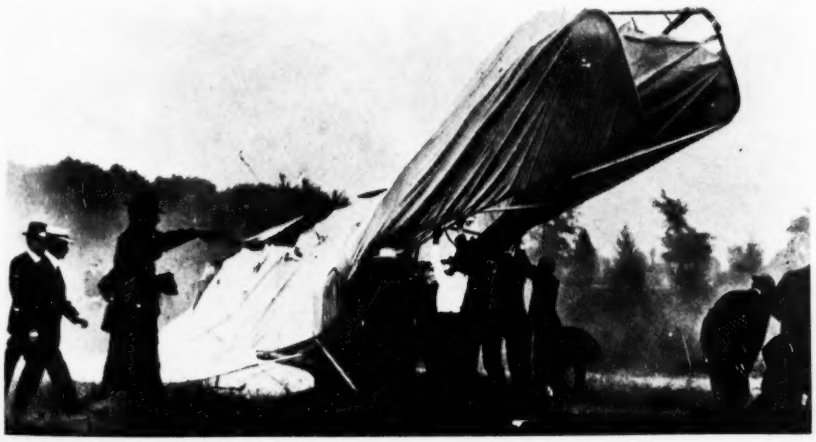
Lieutenant Selfridge died a few hours later in a hospital, the first man to give his life in heavier-than-air powered flight. Only a few months before, Lieutenant Selfridge had become the first Army officer to make a solo flight in a powered airplane, when on 19 May 1908, he flew Alexander Graham Bell's airplane, the "White Wing." Selfridge's death was a blow to the Signal Corps Aeronautical Division. He had been considered by many "the most widely informed expert on dynamics of the air and mechanical flight."

Orville remained in the hospital several weeks. Upon his release he and his brother continued their work. They returned to Fort Myer on 20 June 1909 with an improved version of their 1908 plane.

After a series of practice flights, the Wrights announced that they were ready for the official trials. On 27 July Orville made the first test flight, carrying Lt Frank P. Lahm as passenger. Lt Benjamin D. Foulois flew with Orville on the final test flight on 30 July. The tests were successful and the Army accepted the airplane on 2 August.

Lt Thomas E. Selfridge is pulled from the wreck of the Wright airplane, which proved fatal to the brilliant young Army officer. Orville Wright has been removed and is in the group at the far right. Orville survived the crash which occurred on 17 September 1908 at Fort Myer, Va.

U. S. Air Force photos



Lt Thomas E. Selfridge

It became U. S. Army Aeroplane No. 1.

As part of the contract, the Wrights trained Lt Frederic E. Humphreys and Lieutenant Lahm to fly the airplane. Instruction began on 8 October and on 26 October the students soloed. Lieutenant Humphreys soloed first and became the first Army Aviator. (See inside back cover.)

Lieutenant Foulois reported to College Park, Md., on 20 October and received some instruction from Wilbur Wright, Humphreys, and Lahm.

Navy Lieutenant George C. Sweet's visit to observe the operations at College Park on 3 November resulted in two firsts. Lieutenant Sweet became the first Navy officer to fly in a heavier-than-air machine and the first passenger carried by Lieutenant Lahm.

In November, Humphreys and Lahm returned to duty in their respective basic branches, the Engineers and Cavalry. Lieutenant Foulois, who had moved the Army's only airplane to Fort Sam Houston, Texas, for the winter, received flying instructions from the Wrights by mail. The Wrights sent an instructor to help Lieutenant Foulois master the art of landing.

The Army struggled along with one pilot and one plane until 1911 when Congress appropriated $125,000 for Army Aviation. General Allen received $25,000 immediately and ordered five planes. The first to be delivered was a Curtiss pusher, which became the Army's second plane.

Three Army lieutenants, Paul W. Beck, G. E. M. Kelly, and John C. Walker, Jr., were trained as pilots by Glenn Curtiss. They joined Lieutenant Foulois at Fort Sam Houston in April 1911. A month later, on 10 May 1911, Lieutenant Kelly was killed in a crash and became the first flight training fatality.

In the summer of 1911 the Army had five airplanes, three small balloons, and six officers who held airplane pilot certificates. Having no prescribed test for pilot qualifications, the Army adopted the rules of the Federation Aeronautique International as administered by the Aero Club of America.

By November 1912, the Army had 12 pilots, 39 enlisted men, and 12 airplanes, including hydroplanes. One hydroplane was the Army's first aircraft with the propeller in the front. The pusher plane, which had accounted for most of the fatalities, was condemned by the Signal Corps in 1914.

The Army first used airplanes for observation and adjustment of field artillery fire in November 1912. At the request of the Field Artillery Board, two aircraft were sent to Fort Riley, Kan., for a series of experiments. Portions of a letter from Second Lieutenant H. H. Arnold to the Commanding Officer, Signal Corps Aviation School, Washington, D.C., tell the story. It was written at Fort Riley, Kansas, and dated 6 November 1912:

The first test in connection with artillery took place on the 4th of November; both machines took part in the test. There was no firing by the battery, the flying was done for the purpose of testing out different kinds of signals. There was a wireless station put up in the immediate vicinity of the battery and No. 10, (one of the aircraft) with Lt Arnold, pilot, Lt Bradley, operator, sent messages down to the battery. No. 11, with Lt Milling, pilot, Lt Sands, observer, was equipped with a smoke signal device made at this place. No. 11 sent signals from this device and also dropped cards. The smoke signal device, although improvised, showed that such a device could be used to signal from the aeroplane to the battery. However, on account of the manner in which it was constructed, the dot and dash system of signals could not be used. A system of dots alone had to be used.

On the 5th of November, the aeroplane was used for the first time with the battery actually firing at a target. The target was about 3200 yards from the battery. It was a dark day, a dark target and a dark background for the target. In spite of this, the target was picked up by the aeroplane very easily.

No. 10, equipped with wireless, went up first, sending back by wireless, location of target and afterwards the position of the shots with reference to the target. . . .

These observations put the guns on the target after about four volleys, then this machine returned to the ground and No. 11 went up equipped with the smoke signal and sufficient cards for sending back data. The observer relocated the target and plotted position for the target and the battery on the cards. Then plotted the position of each salvo fired with reference to the target, range and deflection being changed in each case by the data received from the aeroplane.

It was found by using the wireless that aeroplanes could be started out in rear of the battery, salvo being fired just before they reached the battery. Return could be made by the machine as soon as they saw where the shots struck, the message sent back by wireless from the machine while it was making its circle, in order to get to its place to come up in rear of the battery for the second shot. When the machine used the card system, it was found necessary for the machine to make a figure 8 with the point of the crossing directly over the battery, the machine coming up from the rear, the battery firing just before the machine reached the battery. After observing where the shots struck, the machine turned, making a circle so as to come over the battery.

While the machine was making this turn, the observer plotted the position of the hits on the card with reference to the target and dropped it as he passed over the battery.

Then the machine made a second turn, in order to get to its place to come up from the rear to observe the second firing.

Evolution of Army Aviation

Balloon Corps of the Army of the Potomac
Created on 25 Sep 1861 by the Secretary of War. Professor Thaddeus S. C. Lowe was named Chief Aeronaut, a civilian position. The Balloon Corps was disbanded in June 1863.

Balloon Section of the Signal Corps
Created in 1892 by Brig Gen Adolphus W. Greely, Chief Signal Officer. This was the first **military** aeronautic organization in the U. S. Army.

Aeronautical Division of the Signal Corps
Created on 1 Aug 1907 by Office Memorandum No. 6 at the direction of Brig Gen James Allen, Chief Signal Officer of the Army.

Aviation Section of the Signal Corps
Created on 18 Jul 1914 by Congress. At the same time Congress established the aeronautical ratings of Junior Military Aviator, Military Aviator, and Aviation Mechanic.

Bureau of Aircraft Production and **Division of Military Aeronautics**
These two agencies were created on 21 May 1918 by President Wilson and placed directly under the Secretary of War.

Air Service
Created on 24 May 1918 when the War Department recognized the Bureau of Aircraft Production and the Division of Military Aeronautics as a single agency, the Air Service. A chief of Air Service was not named, but on 27 Aug 1918 the position of Director of Air Service was formed. The director was also the Second Assistant Secretary of War.

Air Corps
Created by Congress by the Air Corps Act of 2 Jul 1926. The act also created the position of Assistant Secretary of War for Air.

General Headquarters Air Force
The War Department ordered that the GHQ Air Force would be created by 1 Mar 1935 to assume control over tactical units and to come directly under the General Staff. It existed side by side with the Air Corps. Differences arose between the two commands. On 1 Mar 1939 GHQ Air Force was made responsible to the Chief of Air Corps rather than the General Staff.

Army Air Forces
Created by Army Regulation 95-5, dated 20 Jun 1941. AAF was headed by a chief who was also Deputy Chief of Staff for Air. The chief coordinated and directed the Air Corps, the Air Force Combat Command (formerly the GHQ Air Force), and all other air elements. In March 1949, 82 percent of the officers and 77 percent of the enlisted men of the AAF were from the Air Corps while the rest belonged to the Signal Corps, the Corps of Engineers, the Quartermaster Corps, and other arms and services with the AAF. On 9 Mar 1942 the War Department created autonomous and co-equal commands within its framework: the Army Ground Forces, the Army Air Forces, and the Army Service Forces. The office of Chief of Air Corps and the Air Force Combat Command were dissolved. All elements of the air arm were incorporated into the AAF under a single commanding general and a single air staff. Because it had been created by law, the Air Corps remained in existence as the chief component of the AAF.

Army Aviation
Created on 6 Jun 1942 when the War Department approved Field Artillery organic aviation. The new program came under the direction of the Field Artillery and the Army Ground Forces. It was to supplement the existing system of air support, and specifically to provide air observation for the adjustment of artillery fire.

U. S. Air Force
Created on 26 Jul 1947 when Congress passed the National Security Act of 1947. The act also created the Department of the Air Force and the position of Secretary of the Air Force, which was to be filled by a civilian appointed by the president.

Figure 2

The above is the method of procedure at the present time, although we expect to change it so the firing can be done while the machine is in rear of the battery, the observations being made and the location of hits being plotted on the card in time to be dropped as the machine passes over the battery on its first trip. In this way, time could be saved and it would only be necessary for the machine to make a circle instead of a figure 8. . . .

Today there was one machine with Lieutenant Milling as operator and Lieutenant Sands, observer, used to observe fire. This machine used the dropping card system with good success. The target was about 3400 yards away from the battery. The aeroplane located the target which was invisible from the battery and at the 3d volley had the battery hitting the target.

The President of the Field Artillery Board does not expect to get through with these tests until the 14th of this month—that is, if the weather is good until that time. If the weather is not good it will take much longer.

In August 1913, a bill in Congress called for an aeronautical branch to be a part of the line of the Army. The majority of the Signal Corps officers opposed such a move at that time; instead, on 18 July 1914 Congress created an Aviation Section within the Signal Corps. (Figure 2 traces the organizational changes occurring in the Army's aviation program until 1947.) The Aviation Section increased Army Aviation's strength and scope, gave it a definite status, attracted top grade personnel, and gave manufacturers much needed encouragement.

During World War I the Army had 39 aero squadrons participating in action against the enemy. These included 18 pursuit, 12 corps observation, 3 army observation, 1 night bombardment, and 5 reconnaissance. Assigned to these units were 1,402 pilots and 769 airplane observers. Employing day bombardment and pursuit airplanes, the Army in 150 organized bombardment missions dropped 275,000 pounds of explosives. Army squadrons engaged in over 2,100 combats, 12,830 pursuit flights, 6,672 observation

BY THE BOOK 1920 STYLE

After World War I, flying regulations were left primarily to the discretion of the Air Service station commanders. As a result some unorthodox flying took place. It soon became apparent that something had to be done to curb such aerial goings-on, and so a list of flying regulations was published to cover all Air Service flying activities.

For your interest and possible amusement, here are a few taken from "General Rules—to be followed at all U. S. Flying Fields." They may be of some use to today's pilots, just as they were to yesterday's iron men in wooden ships.

By the way, we are in debt to two publications for this: "The Word," at Patrick AFB, and "Sentry," Eglin AFB.

1. Don't take the machine into the air unless you are satisfied it will fly.
2. Never leave the ground with the motor leaking.
3. Don't turn sharply when taxiing. Instead of turning short, have someone lift the tail around.
4. In taking off, look at the ground and the air.
5. Never get out of a machine with the motor running until the pilot relieving you can reach the engine controls.
6. Pilots should carry hankies in a handy position to wipe off goggles.
7. Riding on the steps, wings, or tail of a machine is prohibited.
8. In case the engine fails on takeoff, land straight ahead regardless of obstacles.
9. Do not trust altitude instruments. Learn to gauge altitude, especially in landing.
10. Never run motor so that blast will blow on another machine.
11. Before you begin a landing glide, see that no machines are under you.
12. Hedge-hopping will not be tolerated.
13. No spins on back or tail slides will be indulged in as they unnecessarily strain the machine.
14. If flying against the wind and you wish to turn and fly with the wind, don't make a sharp turn near the ground. You might crash.
15. Motors have been known to stop during a long glide. If pilot wishes to use motor for landing, he should open throttle.
16. Don't attempt to force machines onto ground with more than flying speed. The result is bouncing and richocheting.
17. Aviators will not wear spurs while flying.
18. You must not take off or land closer than 50 feet to the hangar.
19. Never take a machine into the air until you are familiar with its controls and instruments.
20. If an emergency occurs while flying, land as soon as you can.
21. It is advisable to carry a good pair of cutting pliers in a position where both pilot and passenger can reach them in case of an accident.
22. If you see another machine near you, get out of its way.

—Reprinted from Flight Safety Foundation Bulletin

flights, and 1,174 bombing flights. The enemy was strategically photographed 17,845 times; tens of thousands of rounds were used in ground strafing; and reconnaissance and artillery fire-directing missions were flown on innumerable occasions.

THE AFTERMATH

And then it was over. The armistice was signed in November 1918 and the AEF returned home. With it came men who had new ideas about waging war through airpower.

Despite the tight purse strings accompanying the military demobilization, new and better aircraft were developed and the concepts of strategic bombing and air superiority grew. They flourished in a romantic era of flying which depicted open cockpit airplanes flown by "hell-bent-for-leather" pilots attired in helmet and goggles, boots and scarf.

In some respects the envisioned potential of airpower was exaggerated in this era. However, air superiority and strategic bombing would prove essential to the successful military operation of World War II. But it would also become evident in World War II that airpower alone would not bring victory. Indeed, it would take the combined might of all the allies—on the land, on the sea, and in the air—to bring victory.

The War Department was aware of the diversified capabilities of aviation before World War II. The official American doctrine on the employment of airpower gave equal priority to the missions of ground support and strategic air operations.

Still, before the second war, extremists professed that combat aviation used in mass could break the enemy's will to resist. Only minor cooperation from forces on the ground would be

needed. They believed that the combat effort of airpower should be entirely concentrated on gaining complete air superiority and destroying targets beyond reach of the ground forces by strategic bombing. Air and ground forces need not even be in visual contact. Cooperation between air and grounds forces was visualized only during air operations in the immediate rear areas of the enemy front.

Heated and sometimes passionate disputes resulted over the employment and control of airpower. As America focused its attention on these unfortunate controversies, another concept was developing within the framework of the Army—the concept of Army Aviation.

ARTILLERY BARRAGE

In addition to those in the Air Service, others also felt they had a stake in aviation. The Chief of Field Artillery was aware of the support that balloons and airplanes had provided in World War I. He instigated a thorough study on the Artillery's experiences in combat with aerial observation. He stated that air observation was vital to the effective employment of artillery.

During World War I aerial artillery observation was provided by an observation squadron assigned at corps level. When a mission was requested, corps would dispatch an aircraft which reported by radio to the artillery unit calling for support. When the mission was over, the pilot returned to corps to await another assignment.

The Chief of Field Artillery denounced this system and stressed that artillery commanders did not know the observer and never saw him. This was considered a critical point since Artillery felt that "the point of fall of the artillery shell is an inextricable element of command. The artilleryman cannot do his job if he surrenders this element of command to some stranger who is not responsible to him, who he never sees, and therefore who he cannot trust."

Disagreement between Artillery and the Air Corps grew before World War II. The Air Corps was rapidly developing its concepts of strategic air war and its entire ground support program was weakened.

In relationship to Artillery, the Air Corps felt that merely to furnish an airplane and pilot to carry an expert observer would be to relegate the Air Corps status to more of a service than a combat arm.

Meanwhile, as the 1930s drew to a close Artillery officers fired an increasing barrage of demands for more effective aerial direction of artillery fire. When these demands were not satisfied by standard Air Corps observation squadrons, Artillery officers began advocating the use of light aircraft organic to the units which they served.

In the summer of 1940, 1st Lt James McChord Watson, III, called the Piper Aircraft Corporation and discussed the Artillery's position on the use of light aircraft to adjust fire. Lieutenant Watson informed Piper that the Army was to conduct maneuvers at Camp Beauregard, La., (in Aug 1940) and asked for light aircraft to observe artillery fire. This marked the Army's first contact with Piper.

Mr. Tom Case of Piper flew a J-4 Cub from New Orleans to Camp Beauregard on 12 August 1940. In Piper's first demonstrations for the Army, Mr. Case operated the Cub from a dirt road and flew Lieutenant Watson and others as observers. They had no communication with the ground except by dropping messages or streamers. The only unfavorable part of the demonstrations recalled by Mr. Case was reveille—a loud rendition of "Stars and Stripes" played every morning before daylight.

After the maneuvers Mr. Case returned to the Piper plant at Lock Haven, Pa. Throughout the rest of the year Lieutenant Watson and Mr. Case remained in frequent communication discussing problems and solutions connected with light aircraft and artillery observation.

Interest in light aircraft was mounting throughout the Army. Brig Gen Adna R. Chaffe called Piper Aircraft on 9 February 1941 and discussed the possibility of having light aircraft brought to Fort Knox, Ky., (the Armor School) to evaluate his ideas on directing columns from the air.

General Chaffe felt the light plane could be invaluable to the Army, and was pushing this idea in Washington. He was intensely interested in using light aircraft to control armored columns and to adjust heavy cannon fire from tanks. He felt strongly that all branches of the Army needed organic aviation.

Mr. Case flew a radioless J-3 (Number N-32750, a civilian version of the L-4) to Fort Knox on 10 February and conducted evaluation flights through the 15th. General Chaffe and members of his staff did considerable work with Mr. Case.

PRESSURE IN WASHINGTON

On 18 February 1941, Mr. William T. Piper, Sr., president of Piper Aircraft, wrote the Secretary of War a detailed letter pointing out the great potential of light aircraft in support of the ground forces.

Meanwhile Mr. John E. P. Morgan was directing the campaign in Washington to secure light aviation for the ground forces. Primarily he represented

Piper, Aeronca, and Taylorcraft. Shortly after Mr. Piper had written the Secretary of War, Mr. Morgan received a letter from Mr. Robert A. Lovett, Special Assistant to the Secretary of War. Mr. Lovett stated that the War Department had received numerous letters similar to Mr. Piper's and that a study of the matter was in progress.

Mr. Morgan pressed the War Department for an expression of policy on the employment of light aircraft, stressing that this was necessary before industry could consolidate its efforts and provide the most efficient cooperation. Consequently Maj Benjamin W. Chidlaw was made an official consultant to industry.

Brig Gen Horace Whittaker, Commanding General of the 45th Infantry Division, also expressed an interest in the light airplane. At his request, Mr. Case flew to Camp Bowie, Texas, in the same J-3 he used at Knox. He was joined by Mr. Piper and from 17-23 March they conferred with General Whittaker and conducted numerous demonstration flights.

During this period General Whittaker and Lt Gen Walter Krueger witnessed and discussed the use of light aircraft by the Army. General Whittaker also began corresponding on the subject with the Chief of Field Artillery, Major General Robert M. Danford, a dedicated advocate of making light aviation organic to the Field Artillery. In a few months General Danford was to play a key role in the birth of Army Aviation.

On 19 April 1941, following the events at Camp Bowie, the Piper Aircraft Corporation had a radio installed in Mr. Case's J-3. A standard communications radio of that day, it operated on a frequency of 3105 kc. The radio was not designed for the J-3, but did allow two-way voice communication which General Chaffe used when Mr. Case returned to Fort Knox on 23 April to continue evaluation of the aircraft.

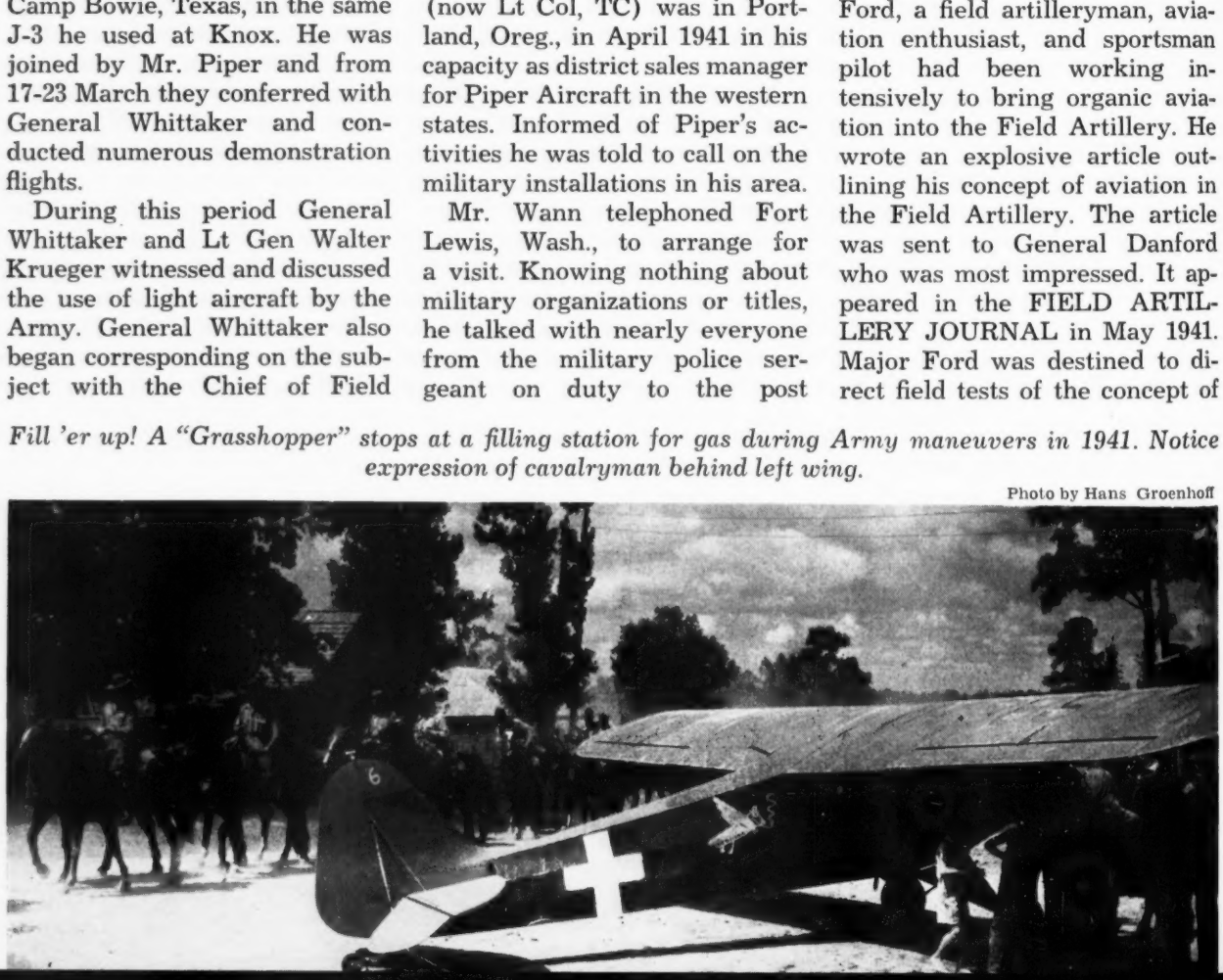
Meanwhile, Piper Aircraft was contacting Army commanders in other sections of the United States in efforts to demonstrate the J-3. Mr. Henry S. Wann (now Lt Col, TC) was in Portland, Oreg., in April 1941 in his capacity as district sales manager for Piper Aircraft in the western states. Informed of Piper's activities he was told to call on the military installations in his area.

Mr. Wann telephoned Fort Lewis, Wash., to arrange for a visit. Knowing nothing about military organizations or titles, he talked with nearly everyone from the military police sergeant on duty to the post sergeant-major. Finally he was connected with a lieutenant colonel who expressed interest in Mr. Wann's mission. He told the Piper representative that he knew light aircraft had a great deal of potential, especially for artillery fire adjustment from the air, but said that it would serve no purpose to come to Fort Lewis at that time. He added that he had a private license, and was especially well aware of the light airplane's uses. He told Mr. Wann his name—Eisenhower. The future president of the United States met Mr. Wann later in the year at the Louisiana Maneuvers, where he recalled their conversation and reasserted his interest and belief in the potential value of the light airplane.

May 1941 was a memorable month in the history of Army Aviation. Major William W. Ford, a field artilleryman, aviation enthusiast, and sportsman pilot had been working intensively to bring organic aviation into the Field Artillery. He wrote an explosive article outlining his concept of aviation in the Field Artillery. The article was sent to General Danford who was most impressed. It appeared in the FIELD ARTILLERY JOURNAL in May 1941. Major Ford was destined to direct field tests of the concept of

Fill 'er up! A "Grasshopper" stops at a filling station for gas during Army maneuvers in 1941. Notice expression of cavalryman behind left wing.

Photo by Hans Groenhoff



Artillery Aviation and to become the first director of the Department of Air Training at Fort Sill, Okla.

Also in May, Mr. Case took J-3 No. N-32750 to Fort Sill for Army exercises and stayed from the 1st through the 4th. Mr. Case flew Army officers on numerous missions to observe troops and artillery fire. He returned to Fort Sill on 7 May and additional evaluation was conducted until the 9th. Mr. Case then returned to Camp Bowie where he joined Mr. Piper, who had arrived with three more pilots and additional J-3s (all equipped with radios). From the 9th through the 25th a concentrated effort was made to have the J-3s live with the Army. Field maintenance was provided by Captain Watson and other services were provided at a civilian airfield. In one instance—on 20 May—the J-3s provided column control for 6½ hours on a troop movement from Berkley, Texas, to Camp Bowie. They landed on the road to refuel—occasionally at a filling station.

Cavalry officers at Fort Riley witnessed demonstrations of the J-3 from 12-14 June and became interested enough to give the light airplanes a more extensive trial later.

On 18 June, Mr. Wann, Mr. Case, and two other Piper employees, James Maurice Helbert and Jules Parmentier took four J-3s to Manchester, Tenn., where they competed against Army Air Force 0-49s and 0-47s in Tennessee Army maneuvers which were already under way. The big advantage of the Cub was the ease with which one man could handle it, and the ease with which it could be pulled under a tree and camouflaged.

TENNESSEE MANEUVERS

The Second Army maneuvers held from 2-28 June 1941 in eastern Tennessee resulted in recommendations to the War Department that light airplanes be made a regular component of the Artillery.

During the maneuvers observers in the Cubs directed artillery fire on the Jake's Mountain Range. Twelve aircraft participated — 8 from Piper and 2 each from Aeronca and Taylorcraft. The light aircraft operated from a clearing on the side of a mountain. This area measured 298 paces long and was completely surrounded by trees.

Observers corrected fire from 155mm guns while flying behind the batteries at 1,000 feet. Staff artillery officers expressed amazement at the excellent visibility from the aircraft, their slow flying speed, and the fact that almost any person could fly these planes without extensive training.

In addition to artillery fire direction, the light planes served in other tactical missions. They were incorporated with regular Air Corps observation squadrons serving both the "Red" and "Blue" armies. They proved highly practical for scouting advanced enemy positions, carrying messages, transporting commanders and staff officers, etc. Altogether the pilots landed on 102 different fields, roads, pastures, and other such areas to demonstrate the unique landing capabilities of light aircraft. In fact, an impromptu landing was necessary to stop the maneuvers.

One of the Cubs was chosen to signal the tank divisions that the maneuver was over. The Cub zoomed over various tank units dropping flares to signal the end of the maneuvers. When one tank group apparently didn't understand the signal, the Cub pilot landed in a field and caught up to the moving tanks by fast taxiing down the road. The tankers got the word.

Four J-3s were sent back to Fort Riley on 1 July so the cavalry could continue its trials. The aircraft remained through the 8th, directing cavalry operations from the air. The Piper representatives lived in the field with the cavalry and carried one mechanic with them. Following these trials official reports on the employment of the light aircraft were sent to Washington.

DESERT MANEUVERS

On 11 July 1941, Piper, Taylorcraft, and Aeronca sent light airplanes to Fort Bliss, Texas, to participate in Army maneuvers. This event is especially notable. During these maneuvers the small airplanes used by the Army were tagged with the nickname "Grasshopper."

The incident occurred on 15 July, the day the maneuvers began. During the morning Mr. Wann was told to proceed from Biggs Field (where the civilian pilots were based) to Headquarters, 1st Cavalry Brigade. He was to deliver a message to the Brigade Commander, Maj Gen Innis P. Swift, and then remain with the general until another pilot and plane relieved him later in the day.

Mr. Wann took off and flew to the area where the brigade was operating. Finding the brigade was not difficult since the troopers, all mounted, stood out plainly in the brown desert. The area was strictly "boondocks," consisting of desert, sand, clumps of grass, cactus.

After some preliminary reconnoitering and a couple of low passes, Mr. Wann landed in an area that was least cluttered by grass clumps. On landing he bounced a bit on the rough ground, then taxied up to the CP.

Mr. Wann delivered the message and informed the general that he had been instructed to remain with him for use as he desired.

General Swift seemed quite impressed and remarked, "You looked just like a damn grasshopper when you landed that thing out there in those boondocks and bounced around."

The general invited Mr. Wann to lunch, which was interrupted when a trooper rode up, saluted, and handed the general a radio message just received from Fort Bliss. It informed General Swift that an airplane had just been dispatched to him for his use. It had taken the message 45 minutes longer to arrive than the Cub.

After lunch Mr. Wann flew the general's aide to Biggs Field on an errand. While at the field, the control officer received a message saying "SEND GRASSHOPPER" and signed "SWIFT." No one knew what it meant until Wann explained it. The general used the light airplane continually during the rest of the maneuver, and the nickname stuck.

In all, 12 light planes participated in the maneuver, which was concluded on 26 July. Aeronca and Taylorcraft each sent two aircraft and Piper provided the rest. The civilians who demonstrated the light aircraft formed the famous Grasshopper Squadron (see fig. 3).

The light plane's participation in the operation was considered a complete success and the Army requested permission to purchase 20 such planes. The request was disapproved by the War Department. However, Lt Col Dwight D. Eisenhower, at the suggestion of Mr. Lovett arranged to have the aviators and planes placed on a per diem rental and expense basis. Previously, members of the Grasshopper Squadron paid their own way.

GRASSHOPPER SQUADRON

Piper Aircraft Corporation

W. T. Piper, Sr.	David Cogswell
T. I. Case	Gordon Curtis
Thomas Piper	James Diegel
Howard Piper	Robert Heath
T. H. Miller	J. M. Helbert
Norman Hockenberry	C. R. Holladay
Henry Kubick	J. W. Miller
W. D. Strohmeier	Henry S. Wann
T. V. Weld	David Kress*
Forest Nearing*	Jules Parmentier
Robert Bowes	H. Sheldon Chadwick

Aeronca Aircraft Corporation

Maurice C. Frye	James Kukla
James Rosing	John Gall*

Taylorcraft Aviation

James Ludwig	Adair Miller
Paul Yates	Ray Carlson*
Phillip Gow*	Frank Parmelee*

Continental Engine Company

Chauncey Chantree*	Percy Hubbel*

* Ground engineers; the others were flying salesmen. John E. P. Morgan also was a member of this group. From Washington, he acted in the capacity of a director or observer.

Figure 3

Following the maneuvers at Fort Bliss, Mr. Case flew to Camp Bowie where, on 30 and 31 July, he briefed General Whittaker and Captain Watson on the happenings in Texas. On 3 August he flew to Beauregard, La., where the Grasshopper Squadron would participate in the Louisiana Maneuvers. This operation would establish in most artillerymen's minds the urgent need for light aviation organic to their branch.

LOUISIANA MANEUVERS

General Danford, already enthused about the performance of the light aircraft in Army maneuvers, visited the British Artillery School at Larkhill in the summer of 1941. British experiments with light aircraft further impressed General Danford and upon returning to the United States he obtained permission to evaluate the planes in the Louisiana Maneuvers.

Grasshopper Squadron pilots flew 12 light planes from 12-14 hours a day in the Third Army portion of the maneuvers which ran from 11-30 August at Beauregard, La. They continued operating in the same area during the combined Second and Third Army maneuvers from 1-30 September. (Members of the Grasshopper Squadron supported the First Army from 6 October to 1 November and again from 3-30 November in the Carolinas. Interstate and Rearwin aircraft companies also

Often it was necessary for members of the Grasshopper Squadron to sleep out in the open during Army maneuvers of 1940-41. Here Jules Parmentier (left) and James Sprague Diegel, both Piper employees, get up with the sun and prepare for another day of flying during the Louisiana Maneuvers of 1941. The aircraft is a J-3, the forerunner of the L-4. Note cots and mosquito bars under the wings.

president took off, flew and landed the J-3.

Later in the maneuvers Colonel Eisenhower returned and asked Mr. Helbert to take him up so he could observe the manuevers from the air. He was particularly interested in watching a cavalry-tank skirmish. Thereafter, Colonel Eisenhower and his staff used the light aircraft constantly. The Grasshopper Squadron flew numerous general officers during the exercise, including General George Patton who had his own plane at the maneuvers and directed armored columns from the air.

The Louisiana Maneuvers indicated that Army Air Force observation units provided by sent planes to these maneuvers.)

Colonel Eisenhower as Chief of Staff, Third Army continued to show the same enthusiasm over light aviation as he had in Fort Lewis. Mr. J. M. Helbert, a Piper member of the Grasshopper Squadron became Colonel Eisenhower's courier pilot during the maneuvers. Mr. Helbert recalls first seeing Colonel Eisenhower at the maneuvers on a 1,000-inch range being used as a landing strip. Mr. Helbert had just flown in when Colonel Eisenhower and Lt Col Sam Davis, Chief of Third Army Air Corps, stopped to look over the planes.

A week later at about 1700 hours Mr. Helbert had returned from a mission and was tying down his Cub on a football field from which he was operating. Colonel Eisenhower approached him and said that he had been doing paperwork all day, and if possible would like to fly for awhile. When asked if he could fly, Colonel Eisenhower said that he had about 600 hours. The two went flying and the future

J. M. Helbert (left) and Tom Case, members of the Grasshopper Squadron, preplan prior to taking Lt Col Dwight D. Eisenhower on a mission during the Louisiana Maneuvers of 1941. Note "grasshopper" band on Case's arm.

Mr. W. T. Piper, Sr., took an active part in demonstrating the J-3 to the Army. At left he is preparing for a flight during the Louisiana Maneuvers of 1941. At right he briefs other Piper members of the Grasshopper Squadron. They are, left to right, John E. P. Morgan, J. M. Helbert, Piper, T. H. Miller (with glasses), David Kress (below Miller), Henry Wann (upper right), and Tom Case.

the Air Support Commands did not provide adequate support. However, the Grasshopper Squadron proved beyond doubt the worth of light aircraft organic to the units they serve. This was substantiated by General Danford's much quoted statement made on 8 October: "The only uniformly satisfactory report of air observation during the recent maneuvers comes from those artillery units where . . . light commercial planes operated by civilian pilots were used."

Following a visit to Fort Sill and a discussion of organic aviation with Major Ford, General Danford again recommended to the War Department that light aircraft manned by Artillery officers be made organic to division and corps artillery units. The division and corps commanders unanimously endorsed this recommendation.

Premature, the recommendation was disapproved. Maj Gen Leslie J. McNair, Chief of Staff at GHQ, felt that a fair trial must be given the new system of Air Support Commands—and generally favored the massing of support elements.

Finally the Office of the Chief

Members of the Grasshopper Squadron take a break during the Louisiana Maneuvers of 1941. They are, left to right, James Diegel, T. H. Miller, Tom Case, Jules Parmentier, Maurice Frye, Dave Kress, and Norman Hockenberry. All are from Piper except Frye who represented Aeronca. The group is standing in front of an Aeronca YO-58.

of Staff ordered a test of General Danford's proposal — with a corps artillery brigade and an infantry division. Pearl Harbor postponed the test, but on 25 February 1942 the 2d Infantry Division and the 13th Field Artillery Brigade were named as the test units. Major Ford, now Lieutenant Colonel, was placed in charge at the suggestion of General Danford, and the test was ordered to proceed at Fort Sill, Okla. General Danford happily announced the news at Fort Sill as he addressed a group of students in a theater.

THE CLASS BEFORE ONE

First Lieutenant Robert R. Williams, now Brigadier General, Commandant of the U. S. Army Aviation School, and Second Lieutenant Delbert L. Bristol (now Colonel) joined Colonel Ford at Fort Sill to help set up the program. Both held civilian pilot licenses and had been working with the aerial observation program for a year.

Also Maj Gordon J. Wolf, a reservist who had been corresponding with Colonel Ford, was recalled to duty. He helped select personnel for the test group, and organize the Air Training Detachment under which they would function.

Colonel Ford and the three officers mentioned above worked out the full program with the assistance of Brig Gen Jesmond D. Balmer, Commandant of the Artillery School.

The Army Air Forces loaned Colonel Ford's group 24 YO-59s, (standard J-3s painted olive drab). In all, 9 pilot instructors, 14 officers, and 21 enlisted student pilots, all having CAA licenses, joined Colonel Ford for the tests. (See fig. 4, right.)

The Field Artillery was charged with responsibility for first echelon maintenance of the aircraft used during the test. The Air Corps was to perform second and third echelon maintenance, but the Field Artillery was required to furnish the Air Corps all necessary historical data relating to the airplane and engine. However, in reality the test group did all of its own maintenance and only depended on the Air Corps for supplies.

Figure 4

Special Orders No. 12

HEADQUARTERS
Field Artillery School
Fort Sill, Oklahoma

SPECIAL ORDERS: January 15, 1942
NO 12: EXTRACT

X X X

10. Under authority granted by paragraph 6, letter OCFA dated December 23, 1941, subject "Air Observation", the persons below are, each with his own consent, designated as pilots for the purpose of flying light observation aircraft operated by the Field Artillery. The military personnel, though participating regularly and frequently in aerial flights, are not entitled to flying pay.

Pilot Instructors

Lt Col WILLIAM W. FORD, 0-12667, F.A.	Director of Air Tng
Mr. RICHARD H. ALLEY	Chief Flt Instr
Mr. LLOYD M. DAMRON	Flt Instr
Mr. EDWARD DRAPELA	Flt Instr
Mr. JOE L. MESSINA	Flt Instr
Mr. THOMAS F. PIPER	Flt Instr
Mr. ALANSON RAWDON	Flt Instr
Mr. T. F. SHIRMACHER	Flt Instr
Mr. H. S. WANN	Flt Instr
Mr. STANFORD J. STELLE	Supt of Maint

Student Pilots

Major GORDON J. WOLF	0-225015	F.A.
Captain ROBERT M. LEICH	0-258194	F.A.
1st Lt F. H. COUNE, JR.	0-338555	F.A.
1st Lt EDWIN FREDERIC HOUSER	0-330734	F.A.
1st Lt PAGET W. THORNTON	0-326311	F.A.
1st Lt ROBERT R. WILLIAMS	0-22962	F.A.
2nd Lt LLOYD M. BORNSTEIN	0-423354	F.A.
2nd Lt DELBERT L. BRISTOL	0-386551	F.A.
2nd Lt MARION J. FORTNER	0-415317	F.A.
2nd Lt STEVE E. HATCH	0-416401	F.A.
2nd Lt BERT LaMERLE JACO	0-300098	F.A.
2nd Lt CHARLES W. LEFEVER	0-409406	F.A.
2nd Lt ROBERT RUSH	0-318541	F.A.
2nd Lt BRYCE WILSON	0-364893	F.A.

Sergeant ALWIN R. HACKBARTH; 20653487, Btry C, 121st F.A., Camp Livingston, La.
Sergeant JAMES W. HILL, JR., 34026570, Hq 1st Bn, 179th F.A., Camp Blanding, Fla.
Sergeant JOSEPH E. MCDONALD, 20817060, Serv Btry, 2nd Bn, 133rd F.A., Camp Bowie, Texas.
Sergeant JOHN S. SARKO, 20651424, Hq Btry, 120th F.A., Camp Livingston, La.
Sergeant JACK K. SVITZER, 20316559, Hq Btry, 1st Bn, 109th F.A., Indiantown Gap Military Reservation, Pa.
Corporal ROBERT M. FORD, 38050577, Hq Btry, 2nd Bn, 133rd F.A., Camp Bowie, Texas.
Corporal THOMAS M. SKELLY, 20314874, Hq Btry, 1st Bn, 108th F.A., Indiantown Gap Military Reservation, Pa.
Corporal ROBERT E. SPAULDING, 20326468, Hq Btry, 1st Bn, 190th F.A., Camp Shelby, Miss.
Corporal ROBERT W. DONOVAN, 37021811, F.A.S. Det (White), Fort Sill, Okla.
Pvt 1cl CHARLES D. HOFFMAN, 37022621, Btry E, 125th F.A., Camp Claiborne, La.
Pvt 1cl WAYNE D. VAN HUSS, 36023418, Hq Btry, 54th F.A. Bn, 12th Tng Regt., F.A.R.T.C., Camp Roberts, Calif.
Private JOHN J. ADKINS, 37119374, Btry E, 32nd Bn, 8th Tng Regt., F.A.R.T.C., Fort Sill, Okla.
Private FRANKLIN LEE CLARK, 33121241, Btry B, 12th Bn, 4th Tng Regt., F.A.R.T.C., Fort Bragg, N. C.
Private ROLAND J. COUTURE, 31012966, Btry D, 172nd F.A., Camp Blanding, Fla.
Private RAYMOND A. GEARHARD, 33115470, Btry C, 8th Bn, 3rd Tng Regt., F.A.R.T.C., Fort Bragg, N. C.
Private WINSTON W. JOHNSON, 34072013, Hq Co., 973rd Tank Destroyer Bn, Camp Shelby, Miss.
Private ROBERT S. LEE, 32095675, Btry B, 7th Obsn Bn, Fort Bragg, N. C.
Private CLYDE CLOE LOVE, JR., 35171340, Btry D, 8th Bn, 3d Tng Regt., F.A.R.T.C., Fort Bragg, N. C.
Private WILLIAM RANDOLPH MATHEWS, JR., 6284169, Hq Btry, 2nd Inf Div Art., Fort Sam Houston, Texas.
Private RICHARD O. PALMER, 14051413, Btry B, 12th Bn, 4th Tng Regt., F.A.R.T.C., Fort Bragg, N. C.
Private GERALD P. UECKER, 37119360, Btry E, 27th Bn, 7th Tng Regt., F.A.R.T.C., Fort Sill, Okla.

X X X

By command of Brigadier General ALLIN:

H. McK. ROPER,
Lt Col, F.A.,
EXECUTIVE.

OFFICIAL:
D. L. DUNLAP
1st Lt, 18th F.A.,
ASSISTANT SECRETARY.

Training began at 0730 on 15 January 1942. The students, often referred to as the Class Before One, were divided into A and B flights. Instruction was broken down into flight and ground training with both of these further divided into stages A, B and C.

Mr. Stanford J. Stelle was in charge of field maintenance instruction for pilots and mechanics. Two practical mechanics, Buck Nearing of Piper and Chet Hammond of Continental, were brought in to help Stelle.

Lieutenant Robert R. Williams, Mr. Dick Alley, Mr. Tony Piper, Mr. Henry Wann, and Mr. Ted Shirmacher set up the flight curriculum and directed short field precision and low aerobatic flight instruction. The training program as outlined above was used by the air training department for the next three years.

Flights A and B of Class Before One

The following personnel, under command of Maj Gordon J. Wolf, trained with the 2d Infantry Division, Fort Sam Houston, Texas:

Maj Gordon J. Wolf	SSgt Alwin R. Hackbarth
Capt Robert M. Leich	SSgt Robert W. Donovan
1st Lt Robert R. Williams	SSgt Robert M. Ford
1st Lt Paget W. Thornton	SSgt William R. Mathews, Jr.
2d Lt Steve E. Hatch	SSgt James Kerr, Jr.
2d Lt Bryce Wilson	Sgt David S. Sweetser
SSgt John S. Sarko	Sgt Walter T. Michalak

The following personnel, under command of Capt Edwin F. Houser, trained with the 13th Field Artillery Brigade, at Fort Bragg, N. C. and Camp Blanding, Fla.

Capt Edwin F. Houser	SSgt James W. Hill, Jr.
1st Lt Felix H. Coune	SSgt Thomas M. Skelly
2d Lt Lloyd M. Bornstein	SSgt Roland J. Couture
2d Lt Charles W. Lefever	Sgt William T. Roulston, Jr.
2d Lt Marion J. Fortner	Sgt Frank C. Baumstark
2d Lt Delbert L. Bristol	Sgt Walter J. Zimmerman
SSgt Joseph E. McDonald	Sgt Ralph E. Hage

Lt Col Ford divided his time between the two test groups.

Figure 5

A large part of the short field work used by the test group and later at Fort Sill reflected a teaching philosophy developed by Mr. Shirmacher when he was a civilian flight instructor. Basically it amounted to showing the student the extremes to which he could carry the aircraft and himself. In this way the student learned both his own and the aircraft's limitations.

To implement such a program Mr. Shirmacher devised extreme maneuvers and incorporated them into the curriculum. Perhaps the most extreme maneuver was the power stall approach, which differed from the power approach in that the airplane was flown at a near stall attitude.

A Cub flown by pilot instructor Ted Shirmacher lands around a curve during training of the Class Before One at Fort Sill in 1942.

The power stall approach was not considered a good approach; in fact, it was considered dangerous. But it fitted into the teaching philosophy and proved to be invaluable in slowing down students who had a tendency to land too fast.

On 28 February 1942 training was completed at Fort Sill and the civilian instructors returned to their homes while the Class Before One students split into two groups (see fig. 5) to continue the tests. Flight B reported to Fort Sam Houston, Texas, to work with the 2d Infantry Division and Flight A proceeded

to Fort Bragg, N. C., and joined the 13th Field Artillery Brigade on 5 March 1942.

Training at Fort Bragg was interrupted on 24 March 1942 when the 13th Field Artillery Brigade was ordered to move to Camp Blanding, Fla. However, Flight A took advantage of the move and provided troop commanders with current information on the state and progress of their columns. Also, it was realized that the light aircraft could have kept the ground commander well informed of a possible enemy threat over a wide area.

During the exercises pilots in both flights practiced innumerable power stall approaches over bamboo poles, received intensive training in flying S turns, eights on and around pylons, chandelles, lazy eights, stalls, short field procedures, road landings, landings on actual strips, ground handling procedures, adjustment of artillery fire, and field maneuvers.

At the end of April 1942, the tests were over and the group reassembled at Fort Sill to await the outcome. Some of the advantages that were established during the tests included:

- the ability and ease with which field artillery personnel could operate the planes;
- the simplicity of operation and maintenance of the planes;
- the ease with which the planes could be dismantled and loaded on 2½-ton trucks for ground movement;
- the effectiveness of the pilot-mechanic concept of having each pilot fully capable of repairing and servicing his aircraft.

The success of the two test groups was reflected in letters of commendation from Brig Gen John B. Anderson, Commanding General, 2d Infantry Division and from Brig Gen J. A. Crane, 13th Field Artillery Brigade commander.

On 7 May 1942 General Anderson wrote to Major Wolf:

> During the period you have been attached to the artillery of the 2d Infantry Division, you and your detachment have been a credit to the Field Artillery . . . . The outstanding work of your detachment in maintenance and a record free of serious accidents are indicative that long hours and total disregard of personal convenience must have been the rule rather than the exception in carrying out your duties.
>
> I especially desire to commend you as the Detachment Commander, and Captain Robert M. Leich as the Engineering Officer for the outstanding performance of duty and for the splendid results obtained while your detachment was under my Command.

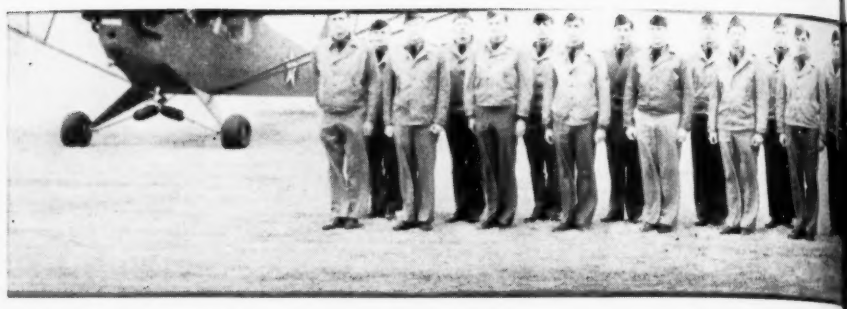
On 5 May 1942 General Crane wrote to the commandant of the Field Artillery School:

> I cannot adequately express my admiration for the skill and enthusiasm with which all the personnel of the flight performed their work here. Never once did they fail to carry out the often seemingly impossible tasks assigned to them, and their record of eight weeks of continuous operation from roads and small unimproved fields under all conditions of weather and terrain without personal injury of any kind and with only one accident

Below left to right, are Lt Gen Leslie J. McNair, Chief of Staff, GHQ; Lt Gen Walter Krueger, Commanding General, Third Army; Maj Gen Mark Clark, Chief of Staff, AGF; and Brig Gen Alfred M. Gruenther, Chief of Staff, Third Army, reviewing a 2d Infantry Division parade in April 1942 at Fort Sam Houston, Texas. At right, planes of Flight B pass the reviewing stand with elements of the 2d Infantry.

that resulted in any damage to material is a glowing tribute to their ability to fly and maintain the airplanes provided them. Their energy, initiative, and cheerful cooperation contributed immeasurably to the successful completion of the test; and if our report on it is approved and air observation is made an organic part of the Field Artillery, the credit will be due to them, and the Field Artillery arm of the Service will owe them a debt of gratitude.

The boards appointed to observe the tests forwarded their reports to the War Department, highly recommending organic aviation for field artillery units. Headquarters, Army Ground Forces also was impressed, but did express concern over the "vulnerability of the light planes." However, AGF also noted that even under unfavorable conditions some missions could be performed, and recommended that the program be implemented without delay. On 6 June 1942 the War Department established organic Army Aviation. At first General McNair was skeptical of the program, but soon became convinced of its worth and "supported it with all his powers."



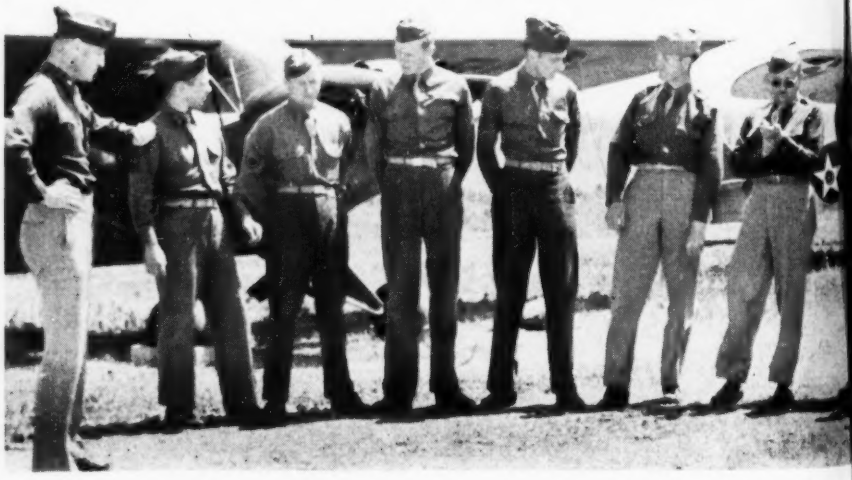
Members of the Class Before One and others who helped bring abo birth of

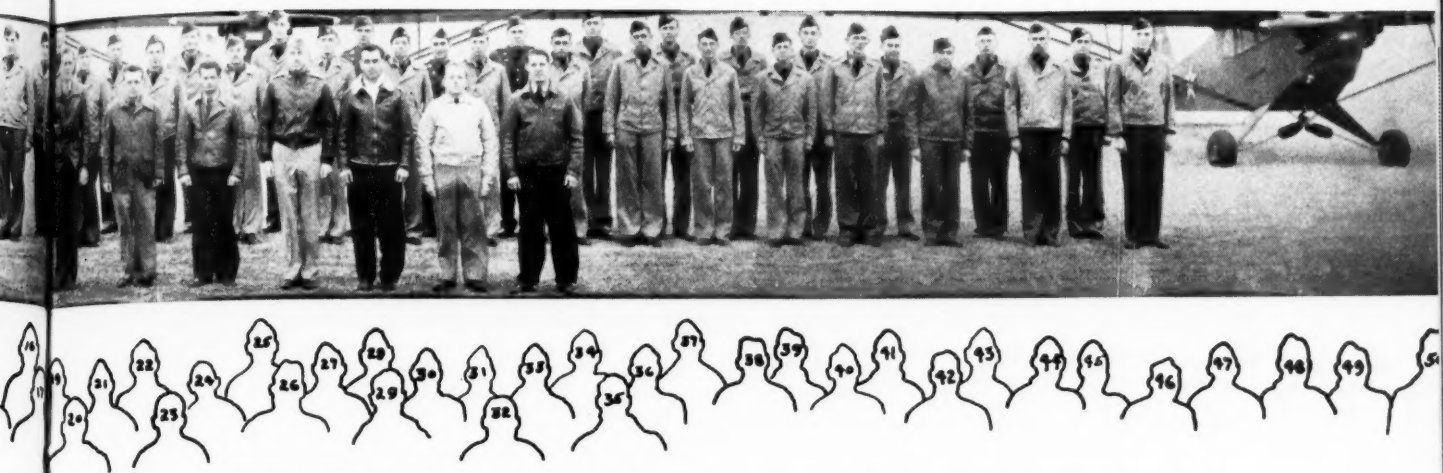
* 1. Bryce Wilson (Bryce)
* 2. Joseph E. McDonald (Joe)
* 3. Gordon J. Wolf (Gordon)
* 4. Marion J. Fortner (Jake)
* 5. Alwin R. Hackbarth (Al)
* 6. Charles W. Lefever (Chuck)
* 7. Robert W. Donovan (Bob)
* 8. Felix H. Coune (Felix)
* 9. Steve E. Hatch (Steve)
*10. James W. Hill, Jr. (Jimmy)
*11. Paget W. Thornton (Paget)
*12. Thomas M. Skelly (Tom)
*13. John S. Sarko (John)
*14. Lloyd M. Bornstein (Lloyd)
*15. Robert R. Williams (Bob)
*16. Delbert L. Bristol (Bris)
17. Forrest H. Nearing
*18. Robert M. Ford (Bob)
*19. Roland J. Couture (Roland)
20. Joe L. Messina (Joe)
*21. William R. Mathews (Randy)
*22. Edwin F. Houser (Ed)
23. Theodore F. Shirmacher (Ted)
*24. Robert M. Leich (Bob)

The War Department directive called for two pilots and one mechanic for each field artillery battalion; 2 in each divisional field artillery headquarters; and 2 in each field artillery brigade or group headquarters. This necessitated 10 aircraft in each infantry division which contained four field artillery battalions; six (and eventually eight) in each armored division, which contained three artillery

From left to right Maj Gen Mark Clark, and Lt Gens Leslie J. McNair and Walter Krueger inspect a Flight B airplane at Fort Sam Houston, Texas, in April 1942. Maj Gordon J. Wolf (right) looks on.

The Flight B detachment of the Class Before One is briefed by Maj Gordon J. Wolf (far left) prior to a mission during the tests at Fort Sam Houston, Texas. They are, left to right, Maj Wolf, SSgt William R. Mathews, Jr., SSgt Robert M. Ford, Sgt David S. Sweetser, SSgt Alwin R. Hackbarth, 2d Lt Steve E. Hatch, Capt Robert M. Leich, SSgt James Kerr, Jr., Sgt





birth of Army Aviation and the establishment of the Department of Air Training at Fort Sill, Okla.

*25. William T. Roulston, Jr. (Bill)
*26. William W. Ford (Wally)
27. Unknown
*28. Lawrence E. Rhodes
29. Stanford J. Stelle
30. Unknown
*31. Walter J. Zimmerman
32. Henry S. Wann (Henry)
33. Unknown
*34. James T. Kerr (Butch)
35. Chester Hammond
36. Unknown
37. Unknown
38. Unknown
39. Unknown
40. Unknown
41. Unknown
42. Unknown
43. Unknown
*44 Joseph R. Caldwell
45. Unknown
*46. Frank C. Baumstark
47. Unknown
*48. Ralph P. Hage
49. Unknown
*50. David Sweetser
— NOT SHOWN —
Richard H. Alley
Lloyd M. Damron
Edward Drapela
Thomas F. Piper (Tony)
Alanson Rawdon

*Participated in Test—March and April 1942

battalions, and (after September 1943) an artillery headquarters. In the field artillery brigade the number of aircraft varied with the number of battalions incorporated.

Responsibility for equipment maintenance and training was divided between the AGF and AAF. Procuring aircraft, spare parts, repair materials, and auxiliary flying equipment fell to the AAF along with the responsibility of third echelon maintenance and basic flight training for student pilots. The AGF would provide the tactical training of the pilots and mechanics. The Department of Air Training, for which plans had already been prepared, officially came into existence on 6 June at Fort Sill to provide this training. Colonel Ford, who was promoted to full colonel on 25 June 1942, was named director.

Walter T. Michalak, SSgt Robert M. Donovan, SSgt John S. Sarko, 2d Lt Bryce Wilson, 1st Lt P. W. Thornton, Capt Robert R. Williams.

Members of Flight A at Fort Bragg, N. C. They are (left to right) Lieutenants "Chuck" Lefever, "Jake" Fortner, and Lloyd Bornstein.

Tired Metal

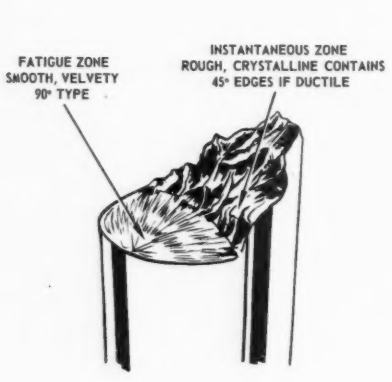
Major Joseph A. Gappa

REMEMBER THE feeling you get from a dozen fast push-ups, several laps around the track, or a session with the chinning bar? Exhausts you to think about it, doesn't it? But you soon get over it, and if you keep it up long enough, exercise will tone and strengthen your muscles. Not so the "muscles" of your aircraft.

When metallic muscles tire, lookout! Here's a quote from the laboratory analysis of a failed bolt that was strongly suspected of causing a crash and seven fatalities:

". . . Even small oscillations can impart appreciable repeated tension, bending, and shear actions. These act upon fine cracks and other weak points in a bolt to cause fatigue. . ."

What is metal fatigue? It's a *progressive* failure. An aircraft part subjected to a tension stress in its upper elastic or plastic range ONE TIME will not fail if the stress does not exceed the ultimate load. However, if the same magnitudes and types of stress were repeated, FAILURE COULD OCCUR. This would be termed a fatigue failure. A typical stress-strain diagram for materials used in aircraft construction (aluminum alloys, magnesium alloys, and some steels) is shown in figure 1.



How then, do we avoid fatigue failures in the aircraft we fly?

First, let's take a brief look at what the designer and manufacturer are faced with and wherein the problem of fatigue plays its part. The aircraft manufacturer of today, unlike his hit-or-miss bamboo and canvas predecessors, designs and builds an aircraft around the mission and type of service it will be expected to give. He considers such things as the number of passengers, equipment, and armament to be carried; performance, such as range, endurance, rate of climb, cruise speed; and numerous other factors. Weighing all these factors, he then designs and builds a minimum weight structure that will safely and economically sustain required loads.

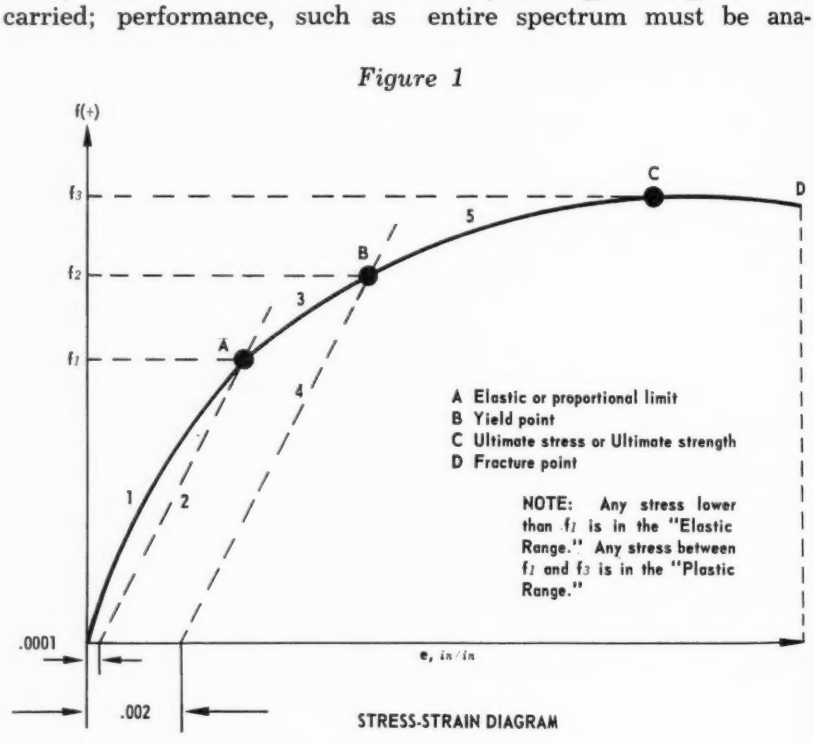
Today's manufacturers have found the most important areas of structural design to be:

STATIC STRENGTH
STIFFNESS AND RIGIDITY
SERVICE LIFE

STATIC STRENGTHS

Loads for which aircraft are designed originate in a wide variety of ways and each must be considered. Some examples are flight gusts, maneuvers, internal and external loads, armament, landing, taxiing, etc. The entire spectrum must be ana-

Figure 1



STRESS-STRAIN DIAGRAM

lyzed to find the maximum of each load and all the possible combinations that will be encountered during normal operation.

The maximum load for which an aircraft is designed is called "limit" load. This is the load the aircraft must sustain without failure while performing the mission for which it was designed. Normally, a 15 percent yield factor of safety is built into an aircraft structure for each "limit" load. This means that applying any of the considered loads would not deform the aircraft to an unacceptable extent if 1.15 times the "limit" load were applied.

Since the possibility of inadvertently overstressing the aircraft always exists, an additional consideration is designed into an aircraft structure on a one time basis. This provides a ONE time 50 percent overstress of the aircraft and completion or safe termination of the mission. It is termed the "ultimate" load, or the "ultimate" safety factor of 1.50.

A load applied to an aircraft which lies between "limit" and "ultimate" will allow a ONE TIME application and safe return, but the structure(s) will be deformed to an unacceptable degree and the affected components must be retired or replaced.

STIFFNESS AND RIGIDITY

Previously, we thought of the strength of an aircraft structure withstanding applied load. Now, let's visualize the same structure resisting deflection. We need only to examine the change in aerodynamic characteristics of airfoil surfaces due to bending and twisting to recognize the importance of stiffness and rigidity as one of the three major design and manufacturing considerations.

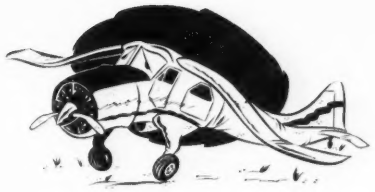
Considerable stress can be applied to a rubber ball without

ruining it. However, the ball loses its identity as a round object while the stress is applied. Should an aircraft component lose its identity under stress and thereby fail to perform the function for which it was designed, it would be useless in spite of any inherent ability to return to its original shape when the stress is removed.

SERVICE LIFE

The cumulative effect of all loads typical of normal use are considerations to be taken into account under the service life heading. These effects dictate frequency and type of inspections, normal periods of overhaul, time replacement of components, maintenance, and servicing. It is in this area that fatigue is found.

Return to figure 1 and visualize repeated tension loads being applied to an aircraft component and the loads are of sufficient magnitude to reach an area not



to exceed the point labeled B. A sufficient number of repetitions will cause the component to FATIGUE. That a fatigue failure will occur in a manner similar to that described above is established fact. But how then can it be forestalled?

Are YOU a commander? If so, YOU can help prevent fatigue failures by using the aircraft under your command as they were designed and built to be used. Overload them or require missions beyond their capability and you're likely to find yourself reviewing more and more accident reports—accidents caused by fatigue failures.

Are YOU an aviator? Then you must learn and abide by manufacturers' recommendations concerning acceptable stress levels. Did YOU report that last hard landing? If YOU overstress an aircraft and fail to report it, YOU could be sentencing your best friend to an accident, or worse.

Are YOU a maintenance officer, mechanic, or inspector? YOUR responsibility to perform each inspection and perform each replacement as scheduled conscientiously, precisely, and professionally is no less than that of a doctor examining his patient. Someone's life may depend on it.

These are the causes and cures for fatigue failures. Stripped of its technical verbiage, the best method of prevention is measured by the Golden Rule.

This article is a condensation of a technical paper by Major Gappa.

From The USAAVNS

The U. S. Army Aviation School's student aviator recruiting teams have completed a CONUS tour, visiting 21 major installations. The reception and support received from local commanders was most gratifying. Several headquarters are sponsoring very active recruiting programs, which contributed immeasurably to the success of our team's efforts.

The team presentation consisted of a color film and color slides depicting all phases of Army Aviation training. Young officers and enlisted men were invited to meet the challenge by applying for this program, thereby providing the optimum in mobility for our soldiers. Advance publicity generated interested and enthusiastic audiences.

It is evident that field commanders worldwide are becoming more aware of what Army Aviation can do for them in the accomplishment of their mission. We at the Aviation School wish to challenge fellow aviators to "carry the ball" in recruiting within their own units. Interest your friends in the unlimited opportunities offered by Army Aviation, and assist them in applying for the program.

DEPT OF TACTICS

For the past few months, the General Subjects Branch has been busily engaged in a massive rewrite program, both updating old material and preparing new units of instruction such as ROAD.

Some of the new units of instruction currently being taught are: Organization of the Divisions (ROAD), Division Aviation Battalion, and Air Cavalry Troop. Other units of instruction being revised to reflect the latest changes are: Nondivisional Army Aviation Organizations, Aircraft Flares, Aerial Photography, and Aerial Observation.

Master Lesson Plans of all these subjects are available on request from the Department of P&NRI, USAAVNS.

During February, FEX 586 was born. FEX 586 is 317 revised to reflect the ROAD organization and doctrine. The Division Aviation Battalion in support of an Infantry Division is also being used as the tactical unit in the Dept of Tactics Fixed Wing Training FEX. Emphasis is placed on the night capability of Army Aviation.

Additional missions included in the revision are night aerial resupply and battlefield illumination using aircraft flares.

The Rotary Wing FEX is also revised to accommodate the ROAD concept, and the two FEXs are conducted concurrently.

When fixed and rotary wing problems are conducted together, it affords students an opportunity to observe each other and will no doubt assist them in future combined operations.

The first concurrent FEXs were supported by the 6th Aviation Operating Detachment, a STRAC unit under operational control of the XVIII Airborne Corps, Fort Bragg, N. C.

The AOD established an instrumented aviation battalion airfield at TAC 1 which afforded students valuable training in using homers, ground controlled approaches, and airfield traffic control. The airfield service section of the AOD provided servicing and refueling.

The Army Aviation Command and Staff Officer Course began with Class 62-1 on 11 April. AAC&SOC 62-1 graduated on 4 May 62 and then participated in LOGEX 62 from 5 May to 12 May 1962. Class 62-2 began on 29 May and will finish on 21

June 62; 62-3 will begin on 10 June and graduate on 5 July. The AAC&SOC provides the student with a comprehensive study of the command and staff aspects of Army Aviation, emphasizing aviation's responsibilities to the supported commander. This course demonstrates the staff relationships at all levels of command that must be understood for Army Aviation to accomplish its designed task, that of providing an additional means by which the supported commander can expeditiously accomplish his mission.

The 3-week curriculum is highlighted by a variety of guest speakers representing such agencies as the Office of the Director of Army Aviation, 3d Army Aviation Staff Section, USA Chemical School, Combat Developments Office, USAABAAR, and the Office of the Surgeon General. This provides additional impetus to the need for an understanding of the varied problems facing an aviation unit or staff section and how to best approach their solution.

The revised field exercises now being presented to the OFWAC and ORWAC classes are proving highly successful. The tactics phase of the AC-1 pilot transition course is presently being revised to include instruction on low-level navigation, survival, and special warfare.

The low-level phase will include a 2-hour classroom presentation on the techniques of nap-of-the-earth navigation. Practical exercises on low-level navigation is integrated into the flying requirements in the tactics phase.

The survival class, presently an 8-hour block of instruction on survival techniques in emergency situations, is programmed to be lengthened to include evasion and escape training.

The special warfare class will be presented to conform with current directives on special warfare operations.

The major training highlight presented by the General Subjects Branch is the 8-hour survival course of instruction which is conducted in a remote area of the Fort Rucker reservation. Aviation flight students are required to actively participate in the techniques of remaining alive—SURVIVING—in any remote area of the world. The students are taught how to descend properly in a parachute, how to position themselves immediately prior to hitting obstacles, such as trees or high tension wires, and how to properly contact the ground terminating their parachute drop.

The basic techniques of self-aid are reviewed. Students are required to build shelters, such as lean-tos, hammocks and parateepees. In addition, the students learn to build fires, improvising means of igniting the fires. Students are taught how to procure food through the use of traps and snares and how to properly test vegetation to assure that it is safe to eat. Poisonous and nonpoisonous snakes are provided in the area to illustrate the difference between the two types. Having procured food satisfactorily, the students are taught how to prepare both animal and plant life for consumption. This is accomplished using live rabbits, chickens, prepared fish, and indigenous vegetation. Finally, a detailed coverage of the methods of signaling and cross-country navigation is presented. Upon completion of this extensive training, the students should be prepared to SURVIVE in any remote area of the world.

FAA Proposes Change to CARs

FAA has proposed that applicants for private or commercial pilot certificates not on active duty and having been discharged for more than 12 months be required to pass the *complete* appropriate written examination. Also proposed is that former military pilots, presently in the armed services but removed from solo flight status (or the equivalent) for reasons other than pilot proficiency, should be permitted to obtain pilot certificates based on military competence as do other former military pilots. Those discharged but removed from such flight status prior to discharge should also be permitted to obtain similar certificates on their military competence.

The Flight Standard Service of FAA desires that all persons who will be affected by these proposals be fully informed. Copies of these proposals are being circulated to afford those who so desire an opportunity to submit comments.

Comments should be submitted in duplicate to: Docket Section, FAA, on or before June 7, 1962.

Your Airway Host

Lieutenant Robert K. Dillon

"It's a beautiful Saturday afternoon," thought the young aviator. The trip down from Fort Bix was interesting, but uneventful. Clear skies, smooth air, and light winds aloft—just right for combat readiness flying! The 5½ hours en route were not exactly tiring, but. . .well, our friend was ready for a shower and shave before going out for the evening. "How 'bout some chow?" he thought. "Sounds good," he answered himself.

"Things are looking up," he was thinking when he rounded the corner and walked into operations. "Welcome to Zilch Army Airfield," the sign proclaimed.

Our young aviator strode up to operations desk. Noticing no one there, he paused for a moment, thinking the operations NCO must have stepped out for a moment and would return shortly. Then he observed someone sitting behind the divider that separated the outer office from the inner. Was it the NCO? the AOD? Or was it the operations officer? Whoever it was, he was obviously engrossed in some sort of magazine (the AVIATION DIGEST perhaps?). Finally the mysterious Mr. X's attention was elicited when the aviator cleared his throat.

Through careful questioning the visiting aviator determined the following: the snack bar at the airfield was closed, but if he hurried he might catch the chow line on main post. Yes, he could get transportation to main post, but he'd have to wait (a civilian taxi could be summoned in a shorter period of time for one dollar).

Two hours later the visiting aviator finally got in the shower. He had waited almost an hour for the transportation, he missed the chow line, and to top it off, there was no hot water!

Is this example farfetched? Did it really happen? Could it happen again? The answer to all three questions is, unfortunately, yes.

Have we as Army Aviators come to expect and demand too much service from our "host"? Let's put the shoe on the other foot for a moment.

At times, particularly on weekends, many airfield commands run at half strength, simply because the traffic does not warrant full operations, alert, and maintenance crews. There's nothing more discouraging to a conscientious operations duty NCO or airdrome officer than to be in the middle of sending or receiving flight plans or posting the latest weather, and have, at the same time, an enterprising pilot pounding his fist on the counter demanding red carpet/VIP treatment.

Obviously our attitudes toward playing the Airway Host as well as the guest need to be examined.

Many pilots—both civilian and military—keep a record of the airports and airfields visited and which ones have the best facilities and services. Their records frequently include a hospitality rating. The matter of ratings and keeping and passing along this information to other aviators will not be discussed here, but let the following account serve as an example of a "Triple A" rating.

Three Army Aviators were returning from a long cross-country flight when they stopped at a Marine Corps Air Station. Conditions were VFR, but the tower instructed the aircraft to hold over a fix until a parade was concluded which was in progress on the airfield. Before even reaching the fix, however, the Beaver was cleared to land.

Before the engine could be shut down, in attendance were two ground handling personnel, an alert vehicle with driver, a fuel truck, and the operations officer. ("What did we *do?*" the aviators wondered.)

Every courtesy of the base was offered to the pilots as they were whisked off to the operations building. Upon arrival at operations, they were asked if they desired food or billets. The reply was unanimous "affirm" to the food but negative on the lodgings.

Lt Dillon is on TDY from the Dept of Maintenance, USAAVNS, to Camp Wolters, Texas, to attend the Rotary Wing Qualification Course. He has approximately 1700 F/W flight hours.

The visiting aviators were informed that while the mess hall was closed at that time, an inflight lunch could be prepared if they would care to wait 20 minutes. All three agreed that the short wait could be used to get the weather and refile; therefore, the invitation for the lunch was accepted.

In due time the group of visitors was presented with a large box containing the food. After thanking their host, they were airborne with a minimum of delay.

It was not until one of the aviators curiously opened the large container that the group began to realize the extent of the Marine's hospitality. Inside, in addition to three half gallons of milk and three quart containers of coffee, were three smaller boxes, each of which contained the following: one-half fried chicken, three sandwiches (made with rye, whole wheat, and white bread), two hard boiled eggs plus salt and pepper, one can of fruit juice with can opener, one can of fruit, one slice of cake, one small pie, several cookies—and a comment card addressed to the mess officer, soliciting suggestions for improvement!

The foregoing is a true account, not fancy. In following up the Marine's thoughtful preparations, three letters of appreciation were sent to the operations officer for the fine meal prepared as well as the courtesies extended.

The key to being a successful host *and* guest is *courtesy*. This could be taken for granted and often is. But in many reported incidents, it was obviously lacking.

Regardless of the size of the facility, courtesy is free, both to give and receive. An airfield operations setup may not be able to provide such luxuries as inflight lunches, and hot and cold running service personnel, but it can, and should, provide and extend every courtesy to visiting aviators of all services. A visitor has a right to expect this. At the same time the operations personnel have a right to expect courtesy and patience from the aviator. This is particularly important when visiting the facilities of sister services.

The unwritten and often indefinable bond that exists among all pilots, as well as the ground personnel who help them, could, and should, be promoted through acts of courtesy. Courtesy is contagious. Let's get infected with it!

MEALS, NOT SNACKS

To those business pilots who may be inclined to "grab snacks" at odd hours rather than take the time to enjoy proper food, particularly when on trips, the following admonitions of an airline doctor should be given serious consideration.

"It may strike you as a bit unusual that eating and safety are positively related, when much has been said on the negative side about eating and overweight. The facts are that while overeating may be a threat to health on a long-term basis, undereating can—at times—become an immediate threat to you and the lives of your passengers.

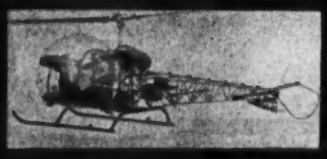
"Your body, just like your aircraft, runs smoothly when the tank is fueled, and it burns about 250 calories per hour under a moderate workload. Your main fuel tank lasts about 4½ hours after a good meal, and when it begins to run dry the reserves are called upon. Sugar is released from the liver, your body's reserve tank, and this reserve tank may last another three or four hours. If you are already operating on your reserves and an emergency suddenly arises when your body needs a sudden burst of energy, the necessary reserve may not be there. Even under normal flying conditions, the reserves eventually can be depleted, and your body rebels against burning up good muscle tissue just because you have not taken time to eat. As your blood sugar level drops, your brain cells are starved and you become fatigued and irritable. Coordination drops off, attention span shortens, and procedural sequences may be inverted or portions dropped out altogether.

"The obvious solution to this flying safety hazard is, as always, prevention. To remain your alert best, give your body the fuel it needs in the form of well-balanced, regular meals."

—Flight Safety Foundation BPSB 62-201, February 1962.

L-19 BIRD DOG

H-13 SIOUX



TWX

U-1A OTTER

THE UNITED STATES ARMY BOARD
FOR AVIATION ACCIDENT RESEARCH

Excts

HU-1 IROQUOIS

H-34 CHOCTAW

H-23 RAVEN

H-13H TOUCHED DOWN TAIL LOW from practice autorotation. Aircraft rocked forward and main rotor blades flexed into and severed tail boom. Major damage to main rotor blades, tail rotor, short shaft, and tail boom. No injuries.

H-13G STRUCK TREES during takeoff from confined area. Major damage to main rotor blades. No injuries.

AO-1C HYDRAULIC PUMP SEAL FAILED in flight, causing loss of all hydraulic fluid. Landing gear was extended by air bottle and aircraft landed with no damage.

H-23D VIBRATED VIOLENTLY in flight and swung left, rolling into 90° bank. Aircraft lost altitude rapidly and crashed. Passenger sustained minor injuries. Aircraft destroyed. Suspect clutch failure.

L-20A STRUCK TREE during night approach. Minor damage to left wing. No injuries. Gusty surface wind, estimated 10-15 knots, considered a factor.

H-13G STRUCK TREES AND BUSHES during attempt to hover out of confined area. Major damage to main rotor blade and tail rotor blades. No injuries.

H-37B LANDING GEAR COLLAPSED during landing. Major damage to clamshell door, left landing gear, left auxiliary fuel tank, left engine nacelle, and fuselage. No injuries. Caused by materiel failure of left main landing gear drag link.

L-20A DOOR FELL OFF in flight. Jettison handle safety wire of right front door broken and not replaced prior to flight. Incident damage. No injuries.

H-13E STRUCK WIRE during low level practice for demonstration. Major damage to pushpull rod, main rotor blades, and mast. No injuries.

L-19A STRUCK TREE during low level spray mission. Incident damage. Pilot sustained minor injury.

H-13H CRASHED during approach to road. Vehicle moved onto road as aircraft approached touchdown point. Pilot overflew intended touchdown point to avoid vehicle and main rotor blades struck tree, causing crash. Aircraft destroyed. No injuries.

H-21C CRASHED in wooded area. Aircraft destroyed. Pilot, copilot, and crewchief killed. Caused by loss of bolt in longitudinal cyclic control rod to aft rotor head. Nut backed off because bolt was installed without safetying.

AO-1 VEERED to right edge of runway during landing roll. Minor damage to tires and one propeller. Suspect uneven prop reversal or dragging right brake.

HU-1A ENGINE FAILED in flight. Aircraft autorotated into trees and was destroyed by crash and fire. No injuries. Caused by failure of No. 2 roller bearing in compressor section.

H-19D STRUCK TREE during simulated forced landing. Incident damage to horizontal stabilizer. No injuries.

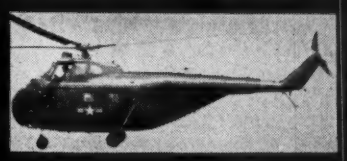
H-23D TAIL ROTOR STRUCK uneven ground during practice autorotation. Incident damage to tail rotor blade and drive shaft. No injuries.

HU-1A STRUCK WIRE during troop lift mission. Major damage. No injuries.

H-13E LANDED HARD during attempt to hover downwind. Incident damage to rear cross tube.

AO-1 MOHAWK H-21 SHAWNEE L-20 BEAVER

...cts From April and May



L-23 SEMINOLE H-37 MOJAVE AC-1 CARIBOU H-19 CHICKASAW

L-19E CRASH LANDED after flying into box canyon. Major damage. No injuries.

H-13H ROTOR STRUCK GROUND during practice autorotation. Major damage. No injuries.

H-13E CRASHED IN WATER during night practice shore approach. Major damage. No injuries.

H-13H LOST COLLECTIVE PITCH at 500 feet. Aircraft destroyed by impact. Pilot sustained minor head injury.

H-23D TAIL ROTOR STRUCK GROUND during abrupt rearward cyclic movement in hovering flight to avoid landing aircraft. Incident damage to tail rotor blades. No injuries.

H-13H STRUCK WIRES during landing approach. Incident damage to main rotor blades. No injuries.

HU-1A LANDED HARD from practice autorotation. Major damage to main rotor blade, tail boom, and tail rotor. No injuries.

H-21C CRASHED AND BURNED during personnel transport flight. Aircraft destroyed. Pilot, copilot, crewchief, and five passengers killed. One survivor sustained major injuries and one survivor escaped with minor injuries. Suspect ski on right main gear tucked under in flight, causing control loss.

HU-1A CRASHED during attempt to hover upslope at computed density altitude of 11,000 feet. Aircraft was unable to maintain rpm, settled to ground, and overturned. Pilot sustained minor cuts and bruises. One passenger sustained broken bone.

H-13H STRUCK TREE during night landing approach. Incident damage. No injuries.

L-23D ENGINE COWL CAME LOOSE in flight. Incident damage to cowl and left wing. No injuries. Suspect dzus fasteners not properly secured.

L-23F NOSE TIRE BLEW OUT during takeoff. Aircraft veered off runway and nose gear collapsed. Major damage to both engines, both propellers, nose gear, and nose section. No injuries.

H-37B CRASHED during maximum performance takeoff attempt. Major damage to all components. No injuries. Gusty wind and downdrafts suspected cause.

H-37B TAIL WHEEL COLLAPSED and tore loose during landing. Materiel failure suspected. No injuries.

H-34C ENGINE FAILED over mountain terrain. Aircraft completed forced landing with no damage. Suspect sump plug failure.

L-20A LOST ADF during actual instrument flight over isolated terrain. Letdown was made and aircraft broke out over unknown area. Aircraft landed on road due to marginal weather conditions and limited fuel. No damage or injuries.

HU-1A VIBRATED IN FLIGHT during search for missing civilian aircraft. Pilot attempted precautionary landing and aircraft crashed, rolling over twice. Aircraft destroyed. One passenger sustained fatal injuries. Pilot and three remaining passengers sustained major injuries. Cause of crash undetermined pending investigation.

L-19A CRASHED AND BURNED during attempted downwind road strip landing. Pilot fatally injured. Gusty wind considered a factor.

Modern Technique for An Old Problem

Lieutenant Harvey E. Hamilton

BY THE TIME an Army Aviator completes the advanced contact phase of training at the U. S. Army Aviation School he is fairly proficient in making normal power approaches from a 180° side approach. However, if the approach were restricted to an unusually low altitude, the average graduate would be unable to perform the approach safely.

In a tactical situation a restriction in altitude may not be uncommon. It could be the result of a low overcast, a unit SOP to prevent enemy radar detection, or a number of other reasons. A young aviator placed under this unusual situation may not have the knowledge and/or experience to recognize the pertinent factors involved in making an approach from this low altitude.

In view of this the Aviation School has integrated a new maneuver with the normal power approach and the contour approach. The new maneuver is called *a tactical approach.*

In addition to the tactical approach the en route absolute altitude between strips has been lowered from 1,200 feet to a ceiling of 700 feet. This is a step toward training the aviator for low-level navigation.

The tactical approach is started from an absolute altitude of 200 feet. This approach presents several new problems. What type pattern should be used? When is the throttle closed and where is the appoach begun? How should flaps be used? How does this approach affect the mechanics of landing the aircraft?

At the Aviation School the approach is being presented in a manner similar to the approach from 500 feet. The problem most frequently encountered is the tendency to fly the pattern too close, thus resulting in steep turns to base and final while close to the ground. The pattern should be slightly wider than that used for an approach from 500 feet. The throttle is closed on base leg in approximately the same position as in making a 90° side approach.

It must be remembered that the aircraft is *below* the normal line of descent when the power is reduced. This means that the pilot has to maintain the 200 feet of altitude until the normal line of descent is reached. When the correct sight picture or line of descent is reached, the remainder of the approach is the same as when making an approach from 500 feet. It is a common tendency to allow the aircraft to lose altitude after the power is reduced and before the airspeed dissipates. This results in a low, flat approach with excessive power and airspeed.

Improper power-flap coordination may lure the unwary pilot into a high pitch, low airspeed condition. After the throttle is closed an approximate level pitch attitude should be maintained until the airspeed approaches 80 mph. Power is then added to maintain altitude. The pilot immediately begins to lower the flaps. Proper power, flap, and pitch coordination is required so the aircraft will intercept the normal line of descent with the correct flap setting for landing and in the power approach attitude. It should be remembered that an approximate level pitch attitude is maintained throughout the approach.

After repeated practice the vigilant pilot will quickly recognize where the power should be removed to prevent either overshooting or undershooting the line of descent.

The Army Aviator who is proficient in low-level navigation and the tactical approach will be better equipped to operate in a tactical situation.

Restraint of Cargo in Helicopters

E. V. Merritt and J. L. Reed

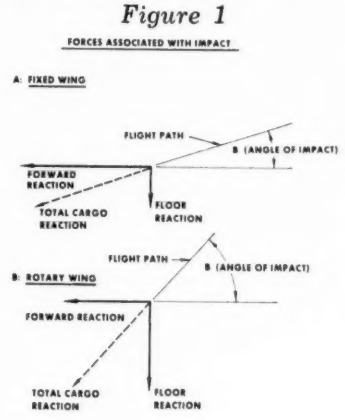
THE PROBLEM of restraining cargo from movement during flight is becoming increasingly important in Army Aviation operations. Back when the cargo capacity of an aircraft was limited to one each, small-size RON kit, the problem did not exist. Anything larger than a case of C rations was automatically restrained from movement by the confines of the aircraft. Today the story is different, and the problem will become more acute as the cargo-carrying capability of Army aircraft is increased.

Adequate restraint of cargo is essential to the safety of the crew, the cargo, and the aircraft. No exception is taken with this doctrine; however, the degree of restraint required is open to question. Many believe that the restraint criteria as established in current publications for helicopters are excessive. These criteria prescribe restraint equal to or greater than that required for most fixed-wing aircraft.

Because of the inherent flight characteristics of the helicopter, the impulse reaction forces associated with cargo restraint in fixed-wing aircraft are not normally encountered. The relatively slow speed of the helicopter in normal flight tends to reduce the effects of gusts and turbulence. Consequently, the impulse reaction forces acting to shift cargo during flight, even in turbulence, are less severe in helicopters than in fixed-wing aircraft, and less restraint is required to prevent movement of cargo.

In an emergency, or even crash landing, the helicopter's steep descent and the angle of impact are such that the line of action of the reaction forces on the cargo is at a greater angle of impact than in a fixed-wing aircraft (see B, fig. 1). Fundamental physics prescribes that the net reaction force on the cargo upon impact will be in the direction of the motion of the system (i.e., the vehicle).

Figure 1



The reaction forces for fixed-wing and rotary-wing aircraft vary both in angularity and magnitude. The magnitude of the net reaction force is a function of the mass of the cargo (weight) and the rate of deceleration. Since fixed-wing aircraft have inherently higher velocities compared with rotary-wing vehicles, the deceleration forces upon impact are usually higher. By resolving the net reaction force into two fundamental components, namely, the forward reaction and the floor reaction, the degree of restraint required can be compared.

As was previously stated, the magnitude of the fixed-wing

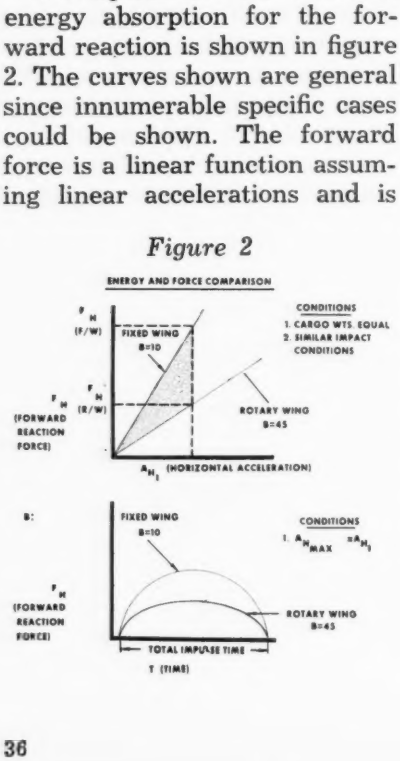
Mr. Merritt and Mr. Reed are with the U. S. Army Transportation Research and Engineering Command, Fort Eustis, Va.

total cargo reaction force should be greater because of the increased impact velocity. Consequently, there is higher rate of decelerations, providing all other factors are constant (time, distance for deceleration, etc.). This, possibly, is being somewhat conservative, but the distinction occurs not completely in magnitude of forces but also in resolution.

Owing to a greater angle of impact (B in fig. 1) because of flight profile, the forward reaction of cargo within a helicopter is approximately equal to the floor reaction. Less energy absorption is required to restrain the forward reaction of cargo in a helicopter than in a fixed-wing aircraft, where the angle of impact is small and the forward reaction comprises a large percentage of the total cargo reaction force. The floor reaction is absorbed by the aircraft structure, whereas the forward reaction of the cargo must be restrained by the tiedown equipment.

A comparison of the force and energy absorption for the forward reaction is shown in figure 2. The curves shown are general since innumerable specific cases could be shown. The forward force is a linear function assuming linear accelerations and is plotted for the two types of aircraft (see fig. 2A). The range of B varies and consequently will affect the slope of the curves; however, the angles selected are a realistic comparative for the two systems.

Figure 2



Examination of the plots shows that the forward reaction ordinate difference sharply increases as the horizontal acceleration increases. If the impulse shock build-up and degradation time versus the forward force are plotted (fig. 2B), the energy comparison can be established. If it is assumed that each aircraft lands under similar force conditions with respect to the cargo (the same deceleration and equal weight), the independent variables are the angle of the impact (B) and the forward reaction forces.

If figure 2A is used, the forward reaction forces for any maximum horizontal acceleration can be determined (example, A_{H1}). By integrating the areas under these curves from zero to A_{H1} and multiplying the specific impulse time shown in figure 2B, the energy difference measured in power units between the two systems can be found. Since the area difference is multiplied by a constant, the shaded area in figure 2A is a good representation of the energy difference.

It can be seen from this comparison that both the force and energy absorption requirements are lower for helicopters than for fixed wing. For the reasons previously stated, it is felt that the criteria for cargo restraint in helicopters are excessive and can be reduced and still retain a realistic degree of safety for the crew and equipment.

LASHING MATERIAL AND EQUIPMENT

The lashing material, or tiedown equipment, presently available is not suitable, primarily because of the time required for installation. This equipment, which consists of A-1A tie-down devices (when available) and rope, is most commonly used for lashing cargo in helicopters. Practically any load of cargo can be secured when this equipment is used, if sufficient time is available for installing the number of lashings required. In the short-haul, shuttle-type of cargo movement operation, the time required for securing cargo becomes a significant factor.

In shuttle operations a turnaround time of from 10 to 15 minutes is not uncommon. That is, each helicopter completes the circuit from loading point to unloading point and back every 10 or 15 minutes. It is a bit ridiculous when the time required for lashing the cargo approaches that required for a complete trip around the circuit. In some cases this can cause the turn-around time on short-haul operations to be doubled.

For a one-trip movement or for a greater distance, a 1-hour turnaround, the time required for securing cargo is of little consideration. However, the helicopter is best suited to short-haul, shuttle-type operations.

In view of this, two conclusions may be reached:

- Securing of cargo to prevent injury to personnel and damage to equipment may be achieved with considerably less restraint than is now required.
- The present method of securing cargo is impractical when the helicopter is engaged in short-haul, shuttle-type operations.

WHAT CAN BE DONE?

Of the two primary problems, excessive restraint and unsuit-

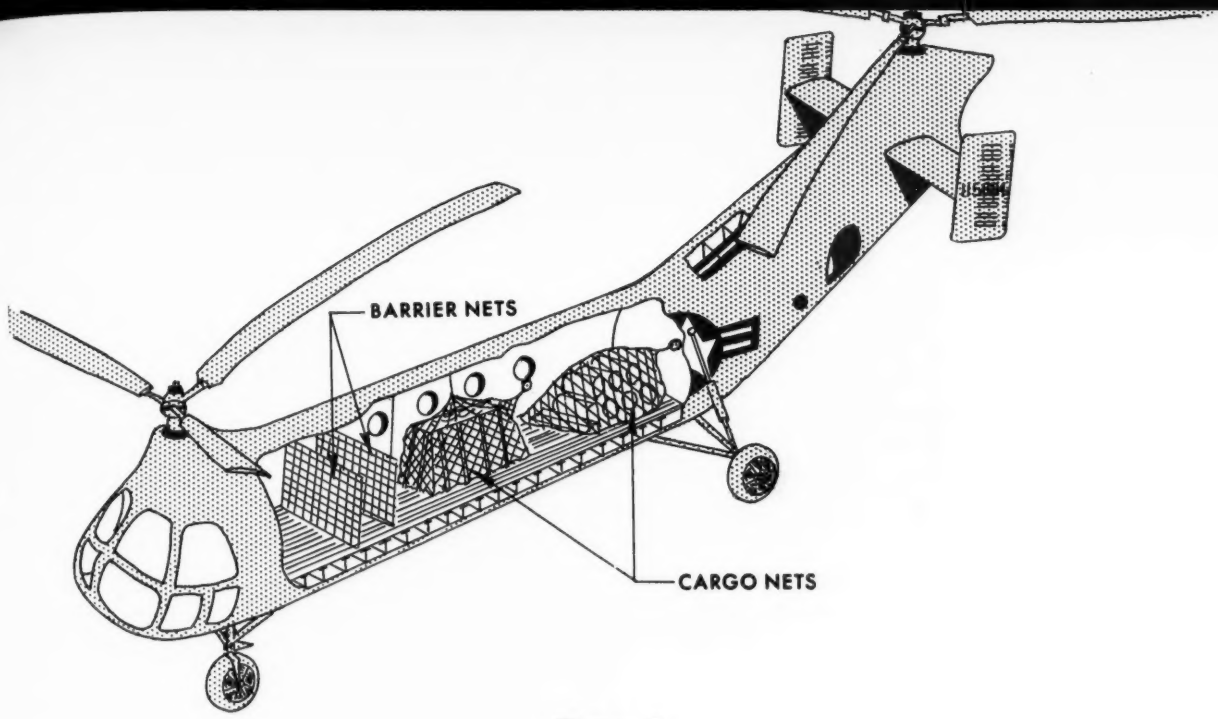


Figure 3

able lashing equipment, the first probably is harder to solve. Reduction of the so-called safety factors, regardless of how excessive they may be, requires a very convincing argument. However, it should be possible through study and tests to determine the degree of restaint actually required.

The U. S. Army Transportation Research Command, Fort Eustis, Va., is investigating at this time to determine the actual forces encountered during flight by various type Army aircraft. This investigation is expected to determine the magnitude of forces to which cargo is subjected. When this information is available, establishment of more realistic criteria should be possible.

The second problem, unsuitable tie-down equipment, is more easily solved, especially after the restraint requirement has been decreased to a more realistic value. One method of providing the required degree of security is to spread web nets over the cargo and secure them to tie-down fittings in the cargo compartment floor. Provision for tightening the net could be made either by installing equipment in the cargo compartment at appropriate locations or carrying it as loose equipment. The nets and tensioning devices (winches) should of course be of lightweight, simple construction and easy to operate.

This is but one of the possible ways to use nets as a means of cargo restraint. Other obvious possibilities include installation of vertical nets across the cargo compartment to restrain the cargo from longitudinal movement. A similar method could be used to protect the crew from forward-moving cargo during crash landings. This method envisions a protective barrier net installed in the forward portion of the cargo compartment. Fastened to substantial structural members of the aircraft, this net would act as a crash barrier to protect the crew (see fig. 3).

Cargo aircraft procured in the future should provide built-in equipment for securing cargo. This can be accomplished as outlined above with extensible nets carried on built-in rollers; net barriers; or similar means. The use of nets would not, of course, be suitable for securing vehicles or other heavy, one-piece loads. In this case, the restraint devices (cable, straps, etc.) could be attached directly to the load and the proper tension applied by a winch or other device.

CONCLUSION

The thoughts and suggestions presented here are not new and are not expected to solve this problem. However, they are intended to point out the need for new criteria established on the basis of helicopter flight characteristics and the need for replacing antiquated cargo restraint methods and equipment. Reprinting restraint criteria established for fixed-wing aircraft and being dependent on the ability of the loading crew to tie properly a Baker bowline and a slippery half hitch are not the best means of securing cargo in helicopters. It is time we stopped degrading the productivity of the helicopter by continued use of unrealistic and outdated methods of cargo restraint.

AERIAL PHOTOGRAPHY

Lieutenant Robert M. Shabram

THE IDEA of taking photographs from the air is nearly as old—or as young—as aviation itself. It goes back over a hundred years when a French pioneer photographer Nadar (Felix Tournachon) fixed a camera in the basket of a balloon and took the first successful aerial photographs near Paris in the spring of 1856. On 13 October 1860, he obtained many excellent views of Paris. Navigator Samuel Archer King and a photographer, J. W. Black, combined their talents to shoot the first pictures in the United States. Taken from a balloon at 1,200 feet above Boston, these pictures were named "Boston as the Eagle and the Wild Goose See It."

Aerial photography was first used for a military purpose in the American Civil War. General McLennan, in command of the Northern Army besieging Richmond, Va., sent up a photographer in a tethered balloon to take pictures of the Confederate troops and batteries. Two prints were made. Each print was marked into 64 squares, and here our first photomap was invented. General McLennan received one, and two balloonists were sent with the other to a position 1,500 feet over the battlefield. From this vantage point they telegraphed General McLennan exact movements of the enemy troops. It worked splendidly. All Confederate attempts to break through Federal lines were disrupted due to shifted and countering Federal reinforcements.

Photographs were first taken from fixed wing aircraft in 1909. On 24 April 1909, Wilbur Wright, accompanied by a photographer, took off from Contocelle, near Rome, and succeeded in obtaining a series of cinematograph pictures. Shortly after this, French photographers started experimenting along similar lines. The first effective stills were those taken by M. Meurisse in December of 1909. During the next five years the work of the pioneers continued and led the way for World War I successes.

During the interim period and shortly before World War II, Col Gen Von Fritsch, Chief of Staff of the German Army, predicted that the side having the best photographic intelligence would win the next war. At the end of World War II, Admiral R. K. Turner stated that photo reconnaissance and photo interpretation had been a major source of information in the Pacific War.

In Korea, photography was again used extensively for timely and accurate information. In 1952, the 2d Infantry Division operations officer planned a raid on Hill 290, but found he did not have enough information on the enemy. A pilot and photographic team went aloft and made a large scale photograph of the hill at 800 feet. This photograph showed details of enemy positions, natural obstructions, opportunities for observation, cover and concealment, fields of fire, and routes of advance. With the aid of this information the raid of Hill 290 was a complete success.

The Army's current self-service photography is a means of gathering intelligence. The dispersed combat and support elements range fast and far; thus, they require more tactical and/or technical information. Army photography supplements the larger, more extensive general photography of the Air Force. For the deep penetration and the extensive coverage needed in large operations, G-2 Air of the Joint Operations Center is notified. They in turn will give the Air Force the mission. The prints from the Air Force

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Lt Shabram was with the Dept. of Tactics, USAAVNS, when he wrote this article. He is now serving in Germany.

mission are made near the Army headquarters and are sent down to the user unit.

Today, Army fixed wing aviators must have a basic knowledge of aerial photography. The Department of Tactics, U. S. Army Aviation School, is responsible for teaching aerial photography to the fixed wing aviator. For many years the basic camera was the KA-24A camera. This camera was used to take vertical and oblique spot photographs.

In the field, the students "buddy ride" in the L-19 Bird Dog. To take pictures of the assigned target, the observer leans out the rear window with the camera. The dangers, limitations, and the commander's needs brought about the development of the KA-20A camera. This camera is mounted in a pod attached to the drop-load shackle of the L-19 or mounted in the camera well of the SD-1 drone. The KA-20A will take 95 exposures on one roll of film and produces a 60% forward overlap when the aircraft is flown at the correct altitude and airspeed. When installed on the L-19 either vertical or oblique photographs can be taken by manually tilting the camera in the pod.

The cameras previously discussed have only day capabilities. In 1962 the KA-20A camera and system will be modified to have day and night capabilities. The new camera will be the KA-39. The system for the KA-39, the KS-54, will include a pod, two photo flare ejectors, a control box and a photo flash detector built into the pod. This system is shown below.

When a pilot transitions into the AO-1 Mohawk he receives about 30 additional hours of aerial photography.

The AO-1 Mohawk is designed for reconnaissance missions. The KS-61 camera system is built into the aircraft, eliminating the need for external equipment as in the L-19. The KS-61 system includes the KA-30 camera, a right and left flare pod, a flash detector, light monitor detector, exposure control panel, photo control panel, a photo system unit and a scanner.

This camera system has four different modes of operation:

- automatic cycle,
- semi-automatic pulse with IMC (image motion compensation),
- manual pulse without IMC,
- night cycle.

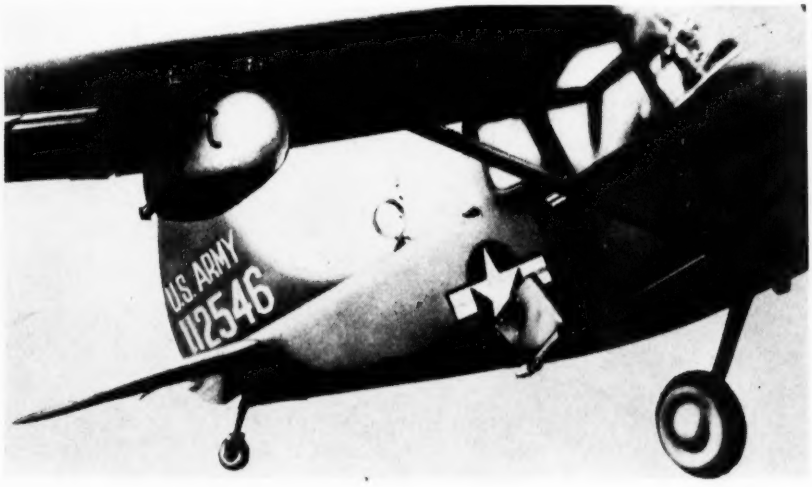
All modes are similar in that the speed and altitude can be set into the system manually. The computer then computes the pulse interval and correct IMC speed. If the aircraft has a scanner this data is supplied automatically.

In all modes utilizing IMC, overlap can be varied but not in excess of 60 percent. In the manual pulse without the IMC mode, the overlap can be varied from about 10 percent to approximately 80 percent by the pilot. The night cycle includes IMC and will automatically give 60 percent overlap, or if the pilot desires the overlap can be decreased but not increased. The future AO-1 Mohawks will have the automatic scanners installed. This scanning device synchronizes the film speed movement with the speed of the aircraft. The height above the terrain, another variable in figuring the proper film speed and IMC, is automatically noted and computed.

A 500 mph plane moves 6-7 feet during a hundredth of a second exposure, thus making it necessary to provide against blurring. This is done by image motion compensation. IMC is accomplished by moving the film in the camera while the shutter is open. The movement of the film is synchronized with the plane's speed/altitude ratio, thus preventing the blurring of the pictures when taken at a high speed and low level.

For night photography the Mohawk is equipped with flare pods which contain 104 of the M112 photoflash cartridges. To fly a night mission the pilot sets the

The KS-54 system. Photo flare holder and camera pod on L-19 Bird Dog.



altitude and speed values into the camera control system and flips the "operate" switch. The interval between flares is controlled by the computer. The computer also provides the pulses to release the flares at the correct rate.

The lens of the camera opens and waits. A flash detector "sees" the flash and closes the shutter. The exposed film is advanced and the shutter reopens, waiting for the next flash. This cycle is repeated until the mission is completed.

A new system, combining airborne radar with photography, lets the Army pilots produce clear, accurate radar photomaps showing enemy terrain though they may never go within many miles of it.

Though the radar is aimed at right angles to the plane's flight path, it produces clearly defined photographic images that look as though they had been shot vertically. Unlike a photo, or the eye, distant objects are clearly separated, distinct, and shown in their true scale, rather than merging together. This eliminates the effect of perspective.

The detail that can be obtained through the use of a very long antenna is reached through the use of a synthetic antenna, or the plane's motion along a flight path. The actual antenna is only 5 feet long. The plane flies along a flight path parallel to, but many miles from, the strip of terrain to be pictured. An automatic pilot controls the pitch, roll and yaw that would tend to wobble the radar beams all over the sky, making potential distortion of the radar image.

A camera photographs the presentations appearing on the cathode ray tube (radar screen). If the inflight processor is installed the film is developed in flight. Otherwise, development must be delayed until the aircraft returns and lands. With the inflight processor in use the observer in the airplane can view the film as soon as it is developed and report significant targets immediately. The film is also ready for immediate use as soon as the plane lands. This film can then be read through a viewer, or any portion of it can be enlarged and printed. These photos, unlike aerial photographs which distort ground distances, are the same scale.

The radar system can be connected to automatic data link by radio. This allows a ground observer to simultaneously monitor a radar screen with the identical presentation as that in the aircraft in flight.

This enlarged photo taken by the U. S. Army Aerial Surveillance and Target Acquisition Platoon shows the highway bridge at Darien, Ga. It was made at 1,500 feet with a KA-30 camera with a 6-inch focal length. A monobath solution was used to develop the negative. Within 8 minutes after the drone landed the negative was ready for a wet reading by the photo interpreter. Enlarged photo below of Hartford, Ala., was taken at 3,700 feet with KA-30 camera and processed by the multibath method.

This new device, the AN/UPD-2 SLAR (side looking aerial radar), is expected to be an aid to ground commanders not only in mapping terrain, but in enabling photo interpreters to pick out information of combat intelligence value. SLAR has a day and night, and virtually all-weather capability.

* * *

Research to improve and increase the present capabilities of the Army's self-service photography continues with the goal of providing the commander with a more complete and accurate picture of the terrain and situation opposing him.

* * *

Research also continues in the

Concluded on page 43

Helicopter Energy Absorption Safety Landing Gear

M. J. Rich

THE ABILITY OF the helicopter to make vertical takeoffs and landings has established its use for both military and commercial operations. While there are many configurations of helicopters, the various designs share one common desirable characteristic: that is the ability to make an autorotative landing after a power failure. This safety feature should be considered as a primary asset, and becomes increasingly more important as a greater number of these machines are utilized for transportation.

In general, the capability of the helicopter to make a safe autorotative landing, within the structural design limits of the landing gear, is a reasonably simple operation providing:

(a) The power failure occurs at combination of altitude and forward speed that permits an established autorotative descent.

(b) The terrain is such that there is a choice of alighting without undue maneuvering.

For the above stated reasons, the cruise flight profile should be selected to permit such operations with sufficient safety in case of power failure. In the case of a multi-engine aircraft, the considerations may well be less critical since flight may be continued on the remaining engine at some reduced cruise forward speed.

However, there is a region of flight that should be avoided. A loss of power in this region can result in autorotative landings that are beyond the capability of the landing gear. This region consists of combinations of low forward speeds and low altitudes from which it is difficult to recover after a loss of power. This region is usually specified in the operating manual of the helicopter.

The pilot can take adequate corrective action providing sufficient altitude and forward speed conditions exist at the time of power failure. After a power loss, the pilot reduces collective pitch to increase the rotor speed. However, the reduction of collective pitch increases the sink speed of the helicopter. The amount of collective control used depends primarily on the altitude at time of power loss.

The result is a region of flight that should be avoided and is shown in figure 1. The low forward speed flight region A can

Figure 1

SCHEMATIC DIAGRAM OF HEIGHT - VELOCITY (H-V) ENVELOPE

Mr. Rich is head of Structures Technology, Sikorsky Aircraft Company, Division of United Aircraft Corporation.

be made less critical if the landing gear could be made more efficient to absorb impact.

The capability of the landing gear is a dominant part of the helicopter system in this problem of the height-velocity envelope. The landing gear as an energy absorber is designed for repeated loading conditions. It is the intent of this article to show the means of augmenting the normal energy absorption without incurring undue weight and operational penalties.

As an immediate goal it is desirable to design an increased capability of the landing gear to absorb greater vertical contact velocities. This increased alighting capability would permit an improvement of safety by contracting the restricted low speed region of the height-velocity envelope as illustrated in figure 1. Normally, the effect of increasing the contact velocity would be a large increase in the landing gear weight. However, the increase of landing gear weight can be kept to a minimum by use of auxiliary energy absorption devices. The augmentation is in series with the regular gear for the purpose of providing additional energy absorption for contact velocities greater than the design values for the standard gear. The auxiliary energy absorption is activated only when impact loads are such to approach the ultimate design condition of the regular gear. This control on activation of the auxiliary energy is by means of the shear pins shown in figure 2.

In order to use the standard gear in series with an energy augmentation device it is important to understand the combined actions that are involved.

The standard gear with flow orifice restriction builds up load resistance as the relative velocity of the strut increases. When the load resisted by the standard gear reaches a load value just below the ultimate gear design load the shear pins in the energy augmentation devices are sheared and the system in series with the standard gear is activated.

After the energy augmentation device is activated the relative velocity to the standard gear is constant and remains constant until the energy device is bottomed or the standard gear bottoms. The standard gear plus energy device act as a series system with constant load resistance up to the bottoming of the energy device.

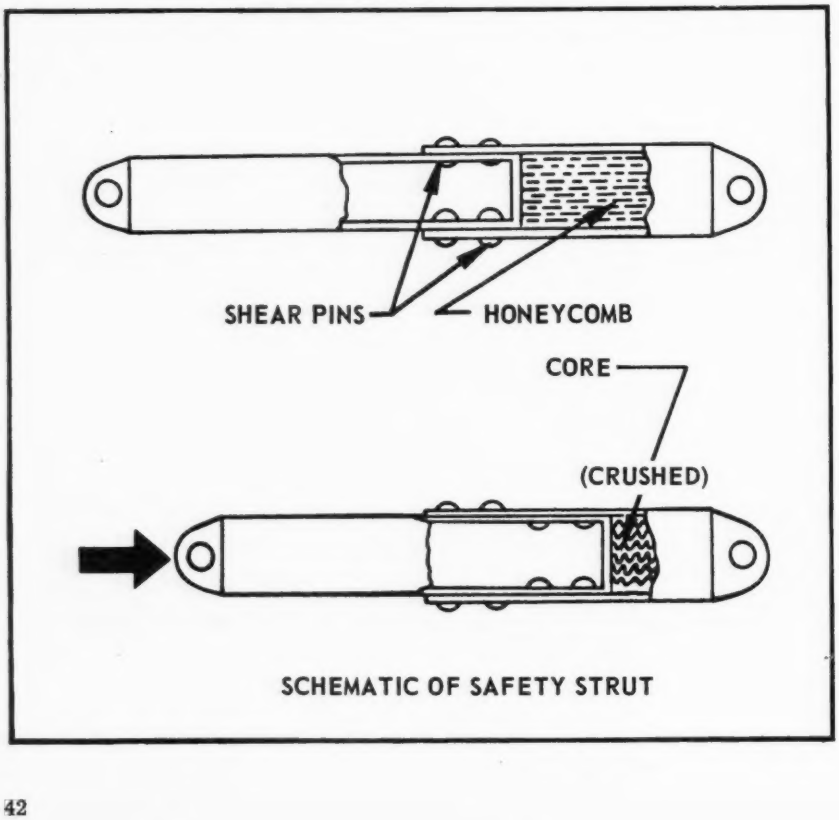
It is important to note that an effective system requires that the energy device "bottoms" after the standard gear. This is required so as to utilize all of the standard gear's capability without exceeding the ultimate design loads in the structure.

The energy strut in the Sikorsky models S-61 and S-62 is located in the upper diagonal strut. The diagonal strut contains a cylindrical cartridge of aluminum honeycomb. The diagonal strut telescopes thus crushing the cartridge. This crushing action provides a large increase in energy absorption that augments the action of the standard gear. The diagonal strut is shown for a S-61L commercial helicopter in figure 3.

The action of the safety strut is only required when an unusually hard landing occurs. As shown in figure 2 there are shear pins to prevent the strut from acting unless the landing impact is sufficient to sever the pins. The shear pins and aluminum honeycomb are designed to act for loads below the breaking strength of the standard gear and the airframe structure.

The concept of the safety strut has been proven in four inci-

Figure 2



SCHEMATIC OF SAFETY STRUT

Figure 3. Commercial S-61L with safety cartridge in diagonal strut.

dents of unusually hard landings with the Sikorsky model S-61 and S-62.

In a particular incident the details of the hard landing are accurately known. In June 1961, a Sikorsky model S-61L commercial helicopter was practicing autorotative landings for the purpose of establishing a height-velocity envelope. During the demonstration the aircraft was inadvertently landed at a vertical ground contact velocity well in excess of the design sink speed (6½ fps). Since instrumentation and camera data was available it was ascertained that the impact was a 15.4 fps.

An inspection of the main alighting gear showed that the shear pins were severed and the honeycomb was crushed 3¾ inches. The damaged gears were replaced and the aircraft was flown back to the Sikorsky main plant. Further inspection revealed no further damage resulted from the hard landing.

The design concept of the safety strut is therefore substantiated from accurate data of the model S-61L. The safety strut has been included in the design of the Sikorsky models S-61L, S-62 and later production of the S-58 helicopter.

The result of the effectiveness of the safety strut is to provide a greater safety in flight operation, particularly where the operation is within the low speed region of the height-velocity envelope.

This article is taken in part from the IAS paper, "Energy Absorption Safety Strut for Helicopter Alighting Gear," No. 62-16 by M. J. Rich, presented at the 33rd Annual IAS Meeting, New York, N. Y.

Continued from page 40

area of film processing. One user test project under study is called MONOBATH. It is briefly described below.

ON A COOL, pleasant day early this year at Fort Stewart, Ga., the U. S. Army Aerial Surveillance and Target Acquisition Platoon launched a SD-1 observation drone to photograph a simulated enemy concentration. Within 8 minutes after the drone returned from the mission, wet negatives were available for interpretation.

A new rapid film processing technique was used in this experiment. In this system the film is processed in a simple solution, called "monobath," containing both the developing agent and the fixing agent. Because of the self-regulating property of monobath, time is not a critical factor. When the film has been processed a minimum length of time, further exposure to the monobath has no effect. Furthermore, since the developing and fixing process are going on at the same time, the requirements for temperature and agitation controls are greatly reduced. If the film is to be used for wet reading only, no further processing is necessary. However, if the film is to be kept for any length of time, it must be water washed and dried.

Results obtained compare favorably with the old multibath system, although the monobath tends to bring about a slight loss in contrast and an increase in the fog level. However, it will not cause a loss in resolution or information content when used in practical camera systems.

Many techniques are now being used in the monobath system of rapid film processing. The one used by the Surveillance Platoon is commonly called the dip method. All of the techniques have their advantages and disadvantages. For instance, one advantage of the dip method is its simplicity. It also gives uniform results, does not require squeegees, storage areas, pumps, rollers, etc., and is most desirable where size and weight are less important.

The use of monobaths can shorten the time required to process film. It is especially useful when an immediate assessment of the exposed film is necessary. There is a certain lack of fine qualities found in film processed in the regular way, but this loss is not enough to detract from the value of the film. When special processors are not available, the film may be developed with the simplest of equipment. A light-proof tent and Norris Development Equipment, B-5, can be used. Or even a simple pan may be substituted for the B-5 equipment.

CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

shenanigans

Many of you won't remember it, but flagpole sitting was a popular sport in the early thirties. And it's coming back strong. Perry D. Turley, Indiana National Guardsman, won the championship title at Terre Haute a couple of years ago with a record 247 days in the air. He went up May 14, 1959 and didn't set foot on solid ground again until January 16, 1960.

To make this marathon roost, Turley hoisted a station wagon to the top of a 45-foot triangle sign. He had a portable television, radio, books, telephone, a small platform for exercise. His food was delivered by rope and bucket. Any further questions are best answered by using your imagination.

But Turley's old fashioned way was too tame for one Army Aviator. Out for a local Raven flight to help maintenance personnel find the source of a transmission oil leak, he spotted a tire hanging from an obstruction light atop a flagpole. Here's how one of several witnesses described what happened:

"I left my office and was going toward the exit drive from the hangar, when a friend, who was also on his way out, said, 'Come on, Let's go outside and watch the helicopter.'

"We went outside and looked up. We saw a helicopter at a near-hover by the flagpole that stands in front of the hangar. On top of the flagpole was a cross beam and lights. A tire was hanging on the north side of the cross beam.

"The helicopter inched forward and its left skid slipped into the opening of the tire. It then backed off without the tire, inched forward again and the left skid re-entered the tire. The aircraft backed off again, this time with the tire hooked to the skid.

"As the aircraft backed further away from the flagpole, the tire hung steadfast. The pole started to bend toward the aircraft. This tended to turn the aircraft slightly to the right. At this point the helicopter started to disappear over the roof of the hangar.

"I panicked and ran back to the hangar drive exit, as I felt a crash was pending. My first thought was to run because I didn't want to see an aircraft crash and people hurt.

"I regained my senses and stood just inside the hangar exit. At this time, it sounded to me as though the helicopter was faltering, because there was a distinct change in the sound of the rotor blades, such as slowing down in rpm and biting the air with all the pitch that could be put in the blades.

Immediately after this, I heard the sound of the blades beating against the side of the hangar and then the crash as the helicopter made ground contact."

We'll let the next aviator, who was flying a Sioux, tell his own story.

Raven Roost

NEARSIGHTED

"As we were going in I noticed a sign sticking about three feet above the ground in the entrance of the heliport and just about the right height to damage a tail rotor. As we flew by I noticed the sign read 'DO NOT REMOVE.'

"I sat the helicopter down facing toward the rear of the sign. I considered getting out of the aircraft and attempting to pull it from the ground, but remembered the words 'DO NOT REMOVE' and thought it would be too hard to remove since it had been intended to stay.

"I then told the passenger over the intercom that I was going to see what it said. I hovered up to the sign and turned around so the printing would be facing the bubble on the left side of the aircraft.

"I couldn't think what it was trying to say, so I decided to move over to the other side so it would be on my side of the aircraft. I was intending to tell the safety officer that I thought its location was unsafe and the unit responsible should remove it.

"As I started to the left to hover over the sign, I felt my left skid bump the sign, but I couldn't see it so I thought I had hit the side of the sign lightly with my left skid and would just pull collective and go slightly higher to get over it and left at the same time.

". . . as I pulled collective, the helicopter began to dip to the left. I applied right cyclic naturally, and the helicopter just continued to pitch to the left.

"I realized that I was hooked under the sign and pushed right pedal to try and get loose. The rotor blades were getting close to the ground and I couldn't do anything else faster than the aircraft was pitching left. It hit the blade what sounded like once and all was over."

Then there was the crewchief who wanted a

NIGHT CHECKOUT

". . . then I went to the tent with the TV. Someone said they wanted beer, so I decided I did, too. A man from the chopper section and myself went to the EM club and bought—as I remember it—two cases of beer.

Inset: He noticed the sign read DO NOT REMOVE . . . and all was over.

"We returned to the tent. The man from the chopper section kept one six pack for himself. Two others and I started drinking the rest of the beer.

"We talked about a lot of things. The main subject we discussed was aerodynamics. My buddy and I had both been interested in it all our lives. There was no heated argument on anything that evening. The only reference I have to the time when we broke up the discussion was the late-late TV show, which had been on for a few minutes.

"I can't say, because I don't know, why or how we managed to decide to fly an L-19.

"I can remember buckling in with the seat belt and shoulder harness. I started the plane and taxied to the south end of the strip. I made a quick mag check and turned the landing light on.

"I took off north and made a downwind turn. I can't remember any of my reactions in the plane. The last thing I remember was flying over the tent area, because of the lights. After then, I must have blacked out in the plane. I do not remember approaching to land.

"The next thing I knew, my buddy was telling me we had to get away from the plane."

Mag drop

Let's get the accident investigation board to tell us about the instructor pilot who wanted a

MAG CHECK

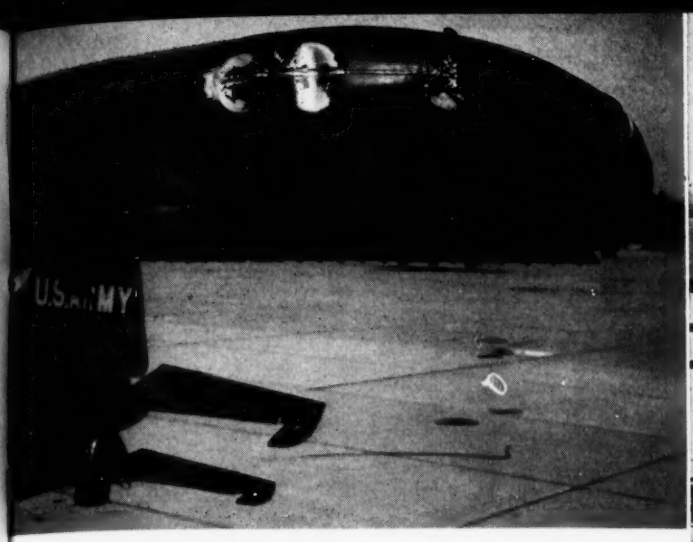
"As the aircraft was paralleling the downwind leg preparatory to entering the traffic pattern at the airfield, it shuddered as though the engine was running rough. The IP declared an emergency and made a safe landing to the parking area. During the approach the shudder did not continue and the aircraft reacted normally.

"After landing, the IP took off his helmet, handed it to [the other pilot aboard] to hold, and frictioned the cyclic and collective controls. He also took off his shoulder harness and seat belt. . .

". . . He then called, [a mechanic] to the aircraft to assist. [He] stood on the right skid with his head inside the cockpit observing the tachometer. [The IP] started to make a high rpm magneto check. As the rpm approached 3,100, [the IP] moved his right hand from the cyclic control toward the magneto switch. At this time the aircraft became airborne, made a violent turn to the right with the nose and right side extremely low. The main rotor blades struck the ground. After turning 270°, the aircraft touched down while moving to the left and slightly forward. This sheared the right skid, throwing [the mechanic] to the ground. Part of the main rotor broke the bubble and [the instructor pilot] was thrown from the cockpit. [The other pilot] was held in the cockpit by his safety belts and exited under his own power after the aircraft came to a halt.

". . . It is the opinion of the Board that an H-13, with the

One for the road



Top: If at first . . .

Right: Choctaws make like Don Quixote

rotor turning at flight rpm, surrounding air calm, and no induced disturbance from other aircraft, cannot become airborne without an application of collective pitch."

Though this Sioux literally chopped itself to pieces, the instructor pilot and mechanic sustained only minor injuries and the other pilot escaped unhurt.

After this, comes the Beaver pilot who believed in the old axiom

TRY, TRY, TRY AGAIN

"I spotted the taxiway into the [parking area] and turned off. The [parking area] was enclosed by a fence with an opening on the taxiway. On each side of the taxiway there was a pole supporting the fence. At a distance of about 30 yards, the opening of the fence appears plenty wide enough for the L-20, so I proceeded on, intending to taxi through the opening.

"As I got to the opening, I felt a bump and the aircraft turned to the left slightly. I thought that the tail wheel had rolled over something and applied some throttle and right brake to proceed through the opening. Almost instantly, I felt a harder bump than before, and the aircraft turned about 45° to the left. I then realized that I had hit the pole with the left wing. I applied hard left brake and considerable throttle in an attempt to back the left wing away from the pole. This did not work because the left wheel would not lock. The aircraft only began to pivot around the pole."

And let's not forget the two Choctaw pilots who discovered that hangars are obstinate about who has the right-of-way.

Or the Bird Dog sewer inspector. . .

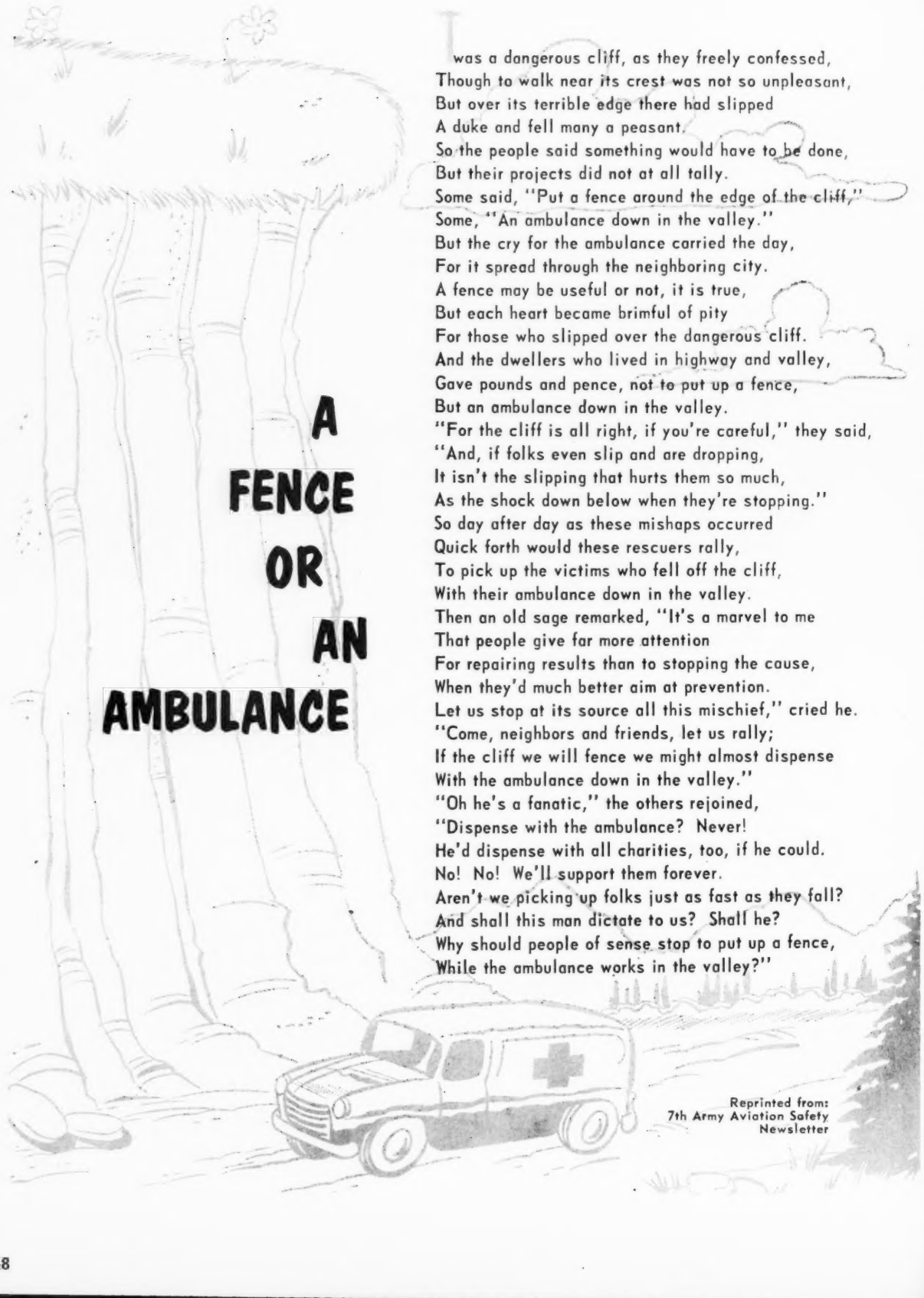
There must be a moral to be drawn from these accidents, but it's . . .

"TIME TO HIT THE HAY"

said the Bird Dog pilot as he started his takeoff, overloaded, in the last 720 feet of a 3,000-foot strip.

Norton! Norton! Are you down there?

"Time to hit the hay"



A FENCE OR AN AMBULANCE

It was a dangerous cliff, as they freely confessed,
Though to walk near its crest was not so unpleasant,
But over its terrible edge there had slipped
A duke and fell many a peasant.
So the people said something would have to be done,
But their projects did not at all tally.
Some said, "Put a fence around the edge of the cliff,"
Some, "An ambulance down in the valley."
But the cry for the ambulance carried the day,
For it spread through the neighboring city.
A fence may be useful or not, it is true,
But each heart became brimful of pity
For those who slipped over the dangerous cliff.
And the dwellers who lived in highway and valley,
Gave pounds and pence, not to put up a fence,
But an ambulance down in the valley.
"For the cliff is all right, if you're careful," they said,
"And, if folks even slip and are dropping,
It isn't the slipping that hurts them so much,
As the shock down below when they're stopping."
So day after day as these mishaps occurred
Quick forth would these rescuers rally,
To pick up the victims who fell off the cliff,
With their ambulance down in the valley.
Then an old sage remarked, "It's a marvel to me
That people give far more attention
For repairing results than to stopping the cause,
When they'd much better aim at prevention.
Let us stop at its source all this mischief," cried he.
"Come, neighbors and friends, let us rally;
If the cliff we will fence we might almost dispense
With the ambulance down in the valley."
"Oh he's a fanatic," the others rejoined,
"Dispense with the ambulance? Never!
He'd dispense with all charities, too, if he could.
No! No! We'll support them forever.
Aren't we picking up folks just as fast as they fall?
And shall this man dictate to us? Shall he?
Why should people of sense stop to put up a fence,
While the ambulance works in the valley?"

Reprinted from:
7th Army Aviation Safety
Newsletter

FREDERIC ERASTUS HUMPHREYS

The First Army Aviator

Born 16 September 1885 at Summit, New Jersey

Died 20 January 1941 at Miami, Florida

In 1909, the Wright Brothers instructed two Army officers in the operation of the first airplane purchased from them. Lieutenant Frederic E. Humphreys, on detached duty from the Corps of Engineers, was one of the officers selected for this instruction. According to Mr. Orville Wright's records, the first Army officer to solo was Lieutenant Humphreys, and he is known as America's "first military aviator." All of his early flights in the first Army airplane were made at the Signal Corps flying school at College Park, Md.

In November 1909, Lieutenant Humphreys was ordered back to duty with his basic branch and in May 1910 he returned to civilian life. He was in the Federal Service from 7 July 1916—4 June 1917 as a captain and on 15 July 1917 returned to active duty as a major. During World War I, he received the rating of Junior Military Aviator, to date from 23 May 1918.

On 5 March 1918, he reported at the Air Service Aviation School at Rockwell Field, Coronado, Calif., for duty requiring him to participate regularly and frequently in aerial flights from 7 March 1918.

Relieved from duty at the Aviation School on 23 May 1918, he proceeded to Cambridge, Mass., where he attended the School of Military Aeronautics, Massachusetts Institute of Technology, until 22 January 1919, when he was assigned to duty with the Technical Section of the Air Service Engineering Division, at McCook Field, Dayton, Ohio. He served at that station until 20 February 1919, when he was honorably discharged from the service.

A FENCE OR AN AMBULANCE

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But over its terrible edge there had slipped
A duke and fell many a peasant.
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But an ambulance down in the valley.
"For the cliff is all right, if you're careful," they said,
"And, if folks even slip and are dropping,
It isn't the slipping that hurts them so much,
As the shock down below when they're stopping."
So day after day as these mishaps occurred
Quick forth would these rescuers rally,
To pick up the victims who fell off the cliff,
With their ambulance down in the valley.
Then an old sage remarked, "It's a marvel to me
That people give far more attention
For repairing results than to stopping the cause,
When they'd much better aim at prevention.
Let us stop at its source all this mischief," cried he.
"Come, neighbors and friends, let us rally;
If the cliff we will fence we might almost dispense
With the ambulance down in the valley."
"Oh he's a fanatic," the others rejoined,
"Dispense with the ambulance? Never!
He'd dispense with all charities, too, if he could.
No! No! We'll support them forever.
Aren't we picking up folks just as fast as they fall?
And shall this man dictate to us? Shall he?
Why should people of sense stop to put up a fence,
While the ambulance works in the valley?"

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Newsletter

FREDERIC ERASTUS HUMPHREYS

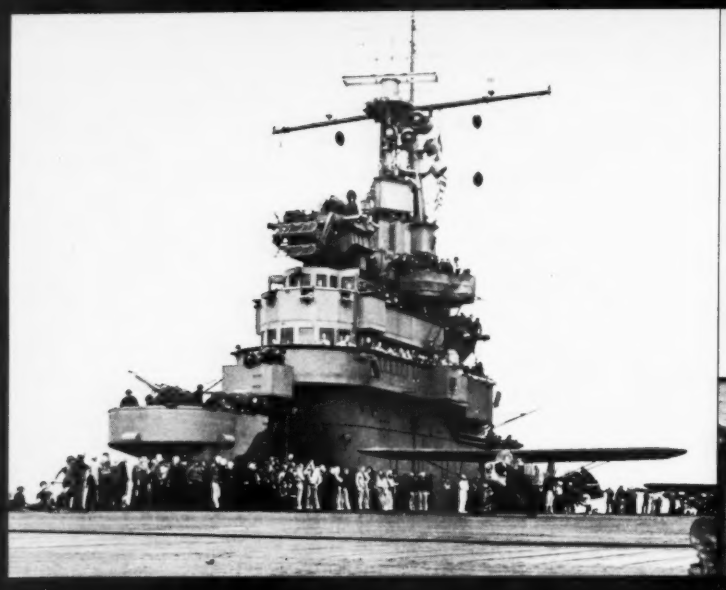
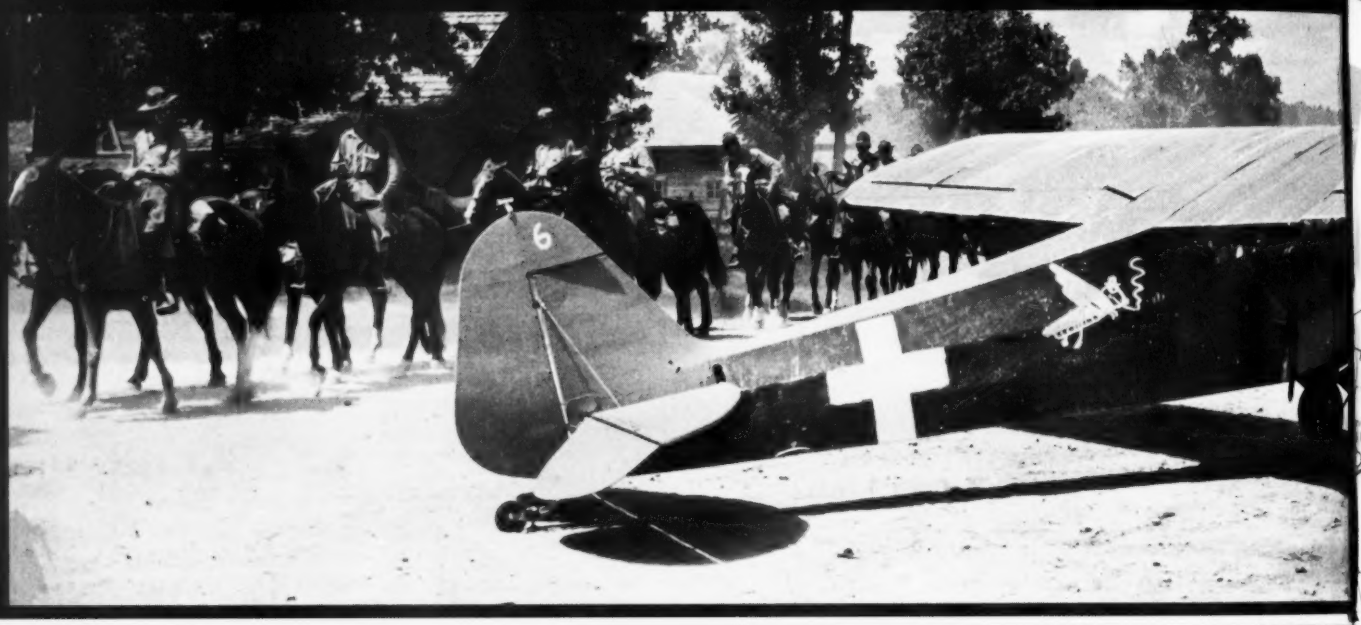
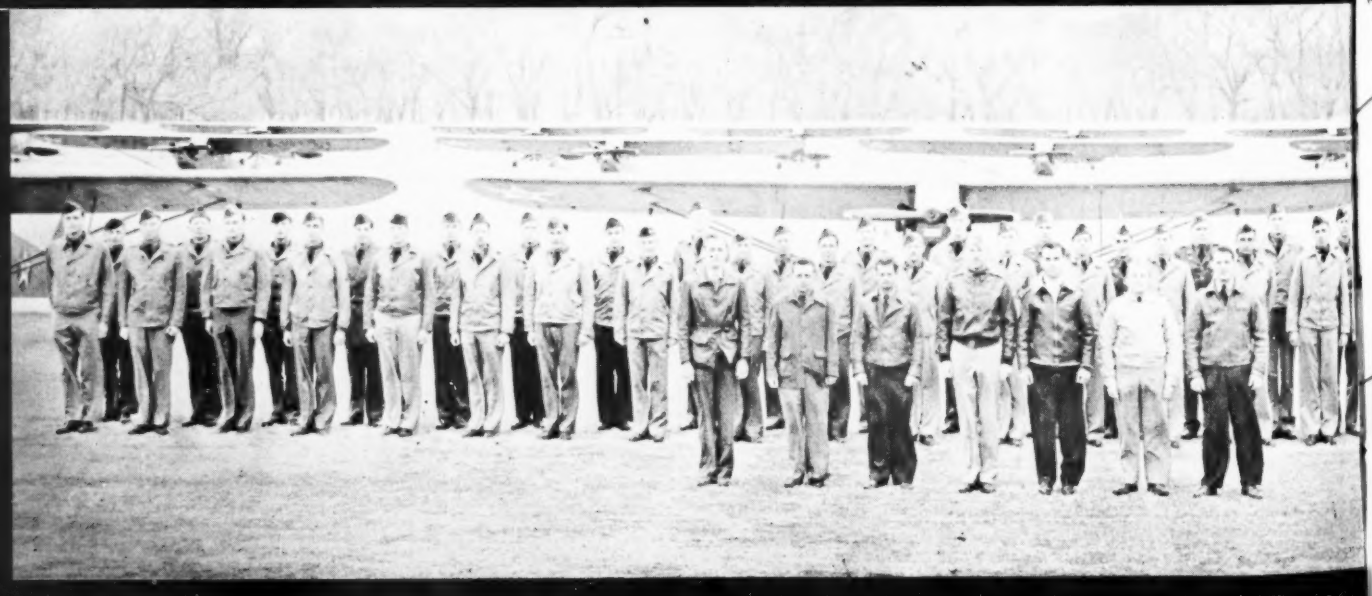
The First Army Aviator

Born 16 September 1885 at Summit, New Jersey

Died 20 January 1941 at Miami, Florida

In 1909, the Wright Brothers instructed two Army officers in the operation of the first airplane purchased from them. Lieutenant Frederic E. Humphreys, on detached duty from the Corps of Engineers, was one of the officers selected for this instruction. According to Mr. Orville Wright's records, the first Army officer to solo was Lieutenant Humphreys, and he is known as America's "first military aviator." All of his early flights in the first Army airplane were made at the Signal Corps flying school at College Park, Md.

In November 1909, Lieutenant Humphreys was ordered back to duty with his basic branch and in May 1910 he returned to civilian life. He was in the Federal Service from 7 July 1916—4 June 1917 as a captain and on 15 July 1917 returned to active duty as a major. During World War I, he received the rating of Junior Military Aviator, to date from 23 May 1918.

On 5 March 1918, he reported at the Air Service Aviation School at Rockwell Field, Coronado, Calif., for duty requiring him to participate regularly and frequently in aerial flights from 7 March 1918.

Relieved from duty at the Aviation School on 23 May 1918, he proceeded to Cambridge, Mass., where he attended the School of Military Aeronautics, Massachusetts Institute of Technology, until 22 January 1919, when he was assigned to duty with the Technical Section of the Air Service Engineering Division, at McCook Field, Dayton, Ohio. He served at that station until 20 February 1919, when he was honorably discharged from the service.